

PC MAGAZINE

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Great Home Computers

PC Labs Tests
15 Top-Selling, Affordable Desktop Computers

Holiday Gifts
80 of Our Favorite
Games, Gadgets,
And Software Titles

LAN-Based PBXs
Cisco, IBM,
3Com, and Others
Go Head to Head

First Looks
5 Printers That
Create Stunning
Photographs

THE INDEPENDENT GUIDE TO PERSONAL COMPUTING AND THE INTERNET

VOL.18 NO.22 DECEMBER 14, 1999

BREAKTHROUGHS



16TH
ANNUAL

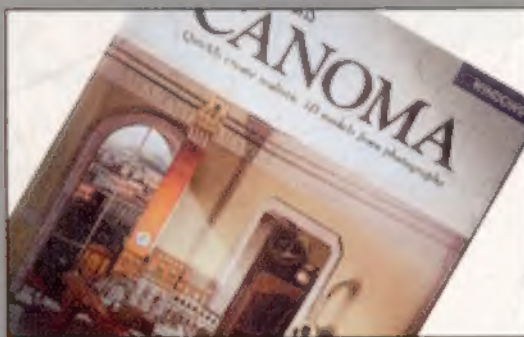
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THAN A
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THE PALM-BASED
PDA WITH
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THE SOFTWARE THAT
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Q

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COMPAQ

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Yet there's even more to whet your appetite.

If your wish list includes playing games with mind-blowing 3D graphics, you can upgrade to a next-generation DVD-ROM drive. Capture, edit, and publish high-quality digital movies and still images with the Digital Creativity Imaging Center.¹ Get the latest in removable storage with an Iomega Zip Built-In™ Drive or CD Read/Writeable Drive.² In fact, whatever you want out of a computer, we can put into it.

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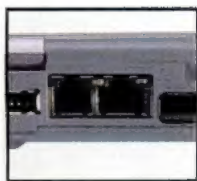
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Pentium III Power — Leading-edge performance is yours, since the TravelMate 340 utilizes the newest and fastest mobile processors and an ultra-fast 100MHz Front Side Bus. Outstanding video performance emanates from the 128-bit 2X AGP integrated video with 2.5MB of video RAM. And all this performance is yours starting at under \$2000 — an unbelievable price for this combination of power and size.



Thin-and-Light (and Cool) — Imagine carrying a notebook that is about the size of the average writing portfolio! The TravelMate 340 is only 1-inch thin and weighs in at about 4 pounds. Yet the magnesium alloy chassis provides outstanding strength and durability. Coupled with a dazzling 12.1" active matrix display, the 340 Series makes the perfect mobile office.



Modem and Networking Ports, and More — Acer has designed the TravelMate 340 to include a complete complement of ports, providing the best connectivity of any notebook today. Besides integrating both a 56K/V.90 modem AND 10/100 Ethernet, everything from external video to USB is included. This eliminates carrying an external port expander device to hook up an external device.



EasyLink™ Combo CD-ROM/Floppy Drive — Tired of lugging around multiple drives and cables? Acer has combined a fast 24X (max.) CD-ROM and a floppy drive into one lightweight unit. This standard combo drive is included with every TravelMate 340 sold; our competitors often charge extra for the external drives. An optional DVD/floppy combo is also available.



New USB Color Camera — Now you can add a new dimension of usability with the optional USB camera. Simply attach it to either side of your TravelMate 340 and plug it into the USB port. Be ready instantly to videoconference over the Web, capture still images, or even capture video clips. Then e-mail these still images or video clip files to friends and family, using the included EasyXpress software.



Dual-View Display — Simply connect an external monitor (or even an LCD projector) to your TravelMate 340 notebook to extend your Windows desktop, with extra space for open applications. Leave your e-mail window open on your notebook while you work on a large spreadsheet on your 17" monitor . . . in a different resolution!



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\$1999 Estimated Street Price

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- 100MHz Front Side Bus
- 64MB SDRAM
- 9GB hard drive
- 12.1" active matrix display
- Integrated 10/100 Ethernet
- Integrated 56K (V.90) modem
- EasyLink™ combo 24x (max.) CD-ROM/FDD
- USB color video camera and software
- Acer TimeMachine
- Preloaded with Microsoft® Windows® 98

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we hear you

The Net Sparks Innovation

Every year, when we choose the finalists and winners of our annual Awards for Technical Excellence, I wonder whether it's been a good year or a bad year for computer products. To say the least, 1999 was interesting. Many of the major products I had hoped to see were missing in action: The Intel Merced chip (now

called Itanium), Microsoft Windows 2000, Netscape Navigator 5, Mac OS X. But as is so often the case these days, the Web came to the rescue with all kinds of new Web-based applications, sites, and software. Yes, 1999 was the year developers really began to take the Web seriously.

In the more traditional categories, we didn't see as much innovation as we expected. Computers continued to get faster, and we saw great new graphics boards that are almost three times as fast as the ones we saw last year. But we've come to expect that.

Similarly, there were no major changes in operating systems. Windows 98 Second Edition and Mac OS 9 are nice little updates, but neither will change the way you use computers. Microsoft teased us with betas of Windows 2000 all year but just couldn't get the enormous code base ready. Mac OS X, the long-promised multitasking, multi-threaded Macintosh operating-system update, remains more dream than reality. Linux got a lot of great attention this year, but the basic OS didn't change much.

Some software applications changed, particularly in niche categories, but the products most of us use every day changed little. Only one traditional productivity package saw any significant innovation: Microsoft Office. And the most interesting new feature in Office 2000—the ability to store all documents in XML format for better Web collaboration—remains a great idea that hardly anyone uses.

So why wasn't it simply a terrible year for innovation? Because of the Web and Web-based apps.

In fact, most of us are likely to have encountered Web-based apps through a site that started off as a directory or search engine and then added new features, such as AltaVista, Excite, Lycos, or Yahoo! Web-based apps are also found in e-commerce engines and in Web-based mail systems.

As in past years, we saw a number of applications

designed to help you gather and create new information. Google came up with a new method of determining the relevancy of Web pages, by analyzing Web sites that point to specific pages through sophisticated text-matching techniques. GuruNet came up with a way of letting any word in any document take you immediately to related information, from definitions to stock quotes. Third Voice lets you add your comments to any Web site so other Third Voice users can see them.

Perhaps more important, many traditional applications are now beginning to be offered in Web-based versions. These applications range from outsourced mail (Critical Path) and graphics (NetStudio.com) to

expense-account reporting (Expenseable.com), accounting and payroll management (ADP, NetLedger, and Payroll Online), and ERP solutions (MySAP). Some companies are offering virtual desktops with storage and PIM applications, such as Visto and Zkey; some, such as eRoom and HotOffice, offer applications that let people share information and collaborate on projects. Desktop.com even tries to re-create the local desktop with its links to applications.

One of the most interesting programs actually runs on traditional PCs. It takes millions of PCs and links them together via the Net to create the world's biggest parallel-computing effort. SETI@Home distributes portions of the data from the search for intelligent extraterrestrial life so your PC can help figure out if there's something unusual lurking in the far reaches of the universe. You're not likely to find anything, but who knows?

In any case, all of this points in the direction of things to come, as we'll see more applications that use the power of the Net and of many computers linked together. In fact, next year I expect the Internet itself, not just the Web, to become a necessary platform for innovation. **PC**

**1999 was
the year
Web-based
applications
changed the
way we look
at software.**



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Michael J. Miller
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questions every Tuesday,
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COVER STORY

100 Technical Excellence Awards

Once again we offer our annual nod to the products and people who have made a lasting contribution to personal computing by advancing the state of the art in computing technologies. As always, innovation, inspiration, and technical progress are the hallmarks of our annual award winners.

NETWORKING

123 PBX Meets the LAN

Is it time to merge your phone system with your data network? PC Magazine Labs tests eight LAN-based PBXs that put call control—and in some cases digitized voice—on your LAN. The result: new ways to link your PC applications with your telephone. *By Frank J. Derfler, Jr., and Les Freed*

HOME PCs

148 A PC for Every Budget

From free to \$2,000 and beyond, there's a home PC to fit every pocket-book. PC Magazine Labs tests 15 machines in two sweet spots—\$800 and \$1,600—to see what the top home PC makers deliver when money is an object. *By Cade Metz*



SUBSTANCE

AND STYLE: This slick new PDA, the Psion Revo, not only has a good-looking design but is also packed with features.

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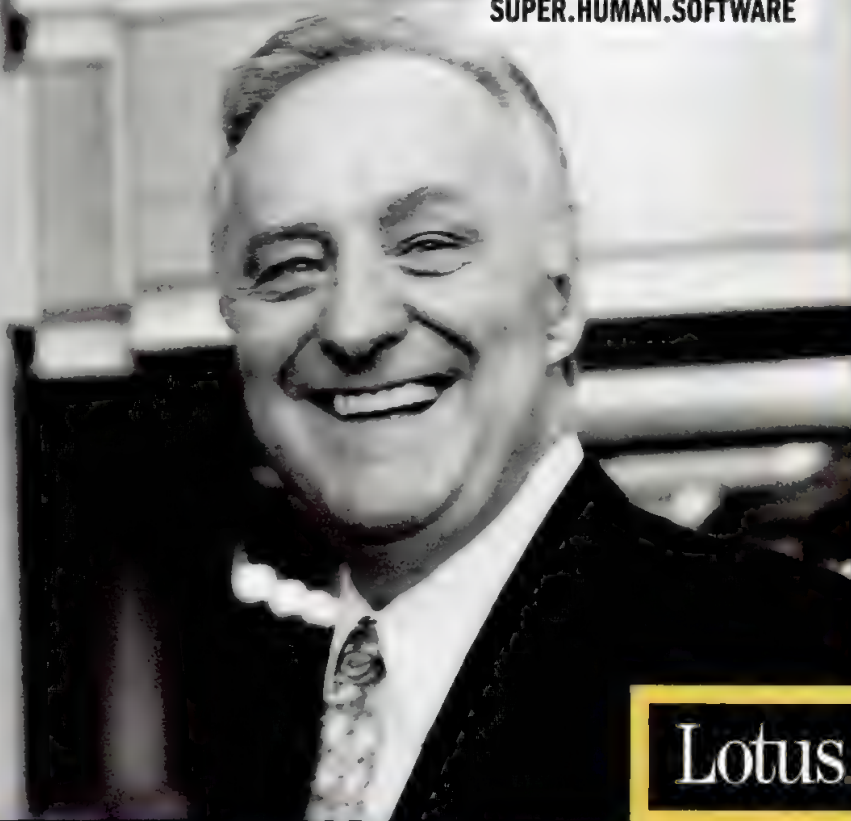
WHAT ARE THE **MOVERS AND SHAKERS** UP TO? AT PRUDENTIAL, BILL FRIEL **AND 67,000 OTHERS** **HAVE CHOSEN LOTUS.**

This is Bill Friel, Chief Information Officer at Prudential. Not long ago, he orchestrated a massive expansion of the number of Lotus Notes[®] users throughout his company around the globe. 67,000 in all. He did it without any major complications and to the great satisfaction of his colleagues. In his words, Lotus has become a "mission-critical" solution. Now Prudential employees can take advantage of the collaborative superiority, reliability and security offered by Lotus Notes and Domino. This lets them communicate with their customers anytime, anywhere to provide outstanding customer service. Becoming a mover and shaker yourself is actually quite simple.

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Display technology is improving dramatically, but we're still a long way from lightweight, flexible screens that will fold up and fit in a pocket. These truly next-generation displays are still incubating inside research labs.

Researchers at IBM are working on flexible notebook displays, but don't expect them for another five to ten years. Xerox is working on its Gyricon display, an ultrathin screen made of millions of plastic balls enclosed in pockets of oil within a sheet made of rubber. The displays are expected in 2001.

Meanwhile, Lucent Technologies and E Ink are working together to bring flexible displays to notebooks, portable phones, and PDAs. The two companies are developing what they call *electronic paper*—flexible, plastic electronic displays that can be manufactured in a process that resembles the way a printing press uses paper and ink.

The electronic paper uses Lucent's plastic transistors and E Ink's electronic ink. The plastic transistors, developed at Lucent's Bell Labs, are flexible and can be manufactured using a relatively simple printing method. Electronic ink is made up of millions of tiny capsules filled with a dark dye and a light pigment. When the capsules are charged, they change color to create different images. The researchers plan to print the transistors on a flexible plastic film coated with the electronic ink.

Lucent and E Ink expect to develop products of their own as well as license

the technology. Potential applications for the displays include electronic books, digital watch displays, and portable computing devices. A prototype display should be ready within a year.



Stinky Sites

Does your online experience lack a certain pungency? In the grand tradition of scratch-and-sniff and Smell-O-Vision, startup DigiScents has developed a technology to enhance your Web experience with a wide array of odors. Web developers will be able to add scents to their sites using a combination of hardware and software.

DigiScents' scent synthesizer will plug into your computer and emit scents when instructed by a smell-enabled Web site. Web sites will be able to license scents from DigiScents' index of thousands of scents and integrate them with games, advertisements, movies, music, and more.



of respondents to a recent PC Magazine Online poll told us they still buy most of their books at bookstores in "the real world." What about Internet shopping? 38 percent of respondents said they shop at Amazon.com, 8 percent said they buy most of their books at barnesandnoble.com, and 4 percent told us they get their books from other online stores.

This Is No Ordinary Display

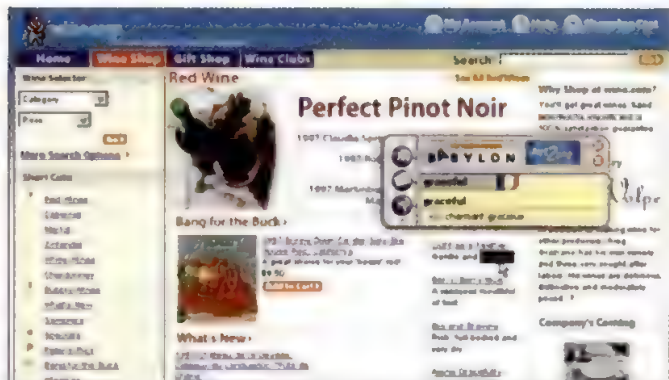
Here's a new twist on flat-panel displays: built-in television tuners. Until recently, the only way to watch TV on your computer monitor was to install a TV tuner card in your PC. Now you have another option. Samsung plans to start shipping its flat-panel TV-and-monitor combos—the Samsung SyncMaster 150MP (15-inch) and SyncMaster 170MP (17-inch)—early next year. The flat-panels will have built-in TV tuners that receive both RF and cable television signals. They'll support the NTSC and PAL/SECAM video formats, as well as U.S. closed-captioned and bilingual broadcasts. You'll be able to watch TV either in full screen or in a window. And you'll be able to attach a VCR, DVD player, camcorder, or cable to the combo. Samsung has not yet set pricing.



Instant Translations

Seventy percent of all PC users are non-English-speaking, but 80 percent of Web content is in English, according to Babylon.com, an Israel-based

translates from English to Dutch, French, German, Hebrew, Italian, Japanese, Portuguese, and Spanish, with classical and simplified Mandarin Chinese available next



developer of instant-translation software. Recently launched in the U.S., the free Babylon single-click translator can help those who don't speak English cope with the Web by turning English into eight other languages with a click of the mouse. When you click on a word in any text document—online or off-line—its translation instantly pops up in a window. The utility currently

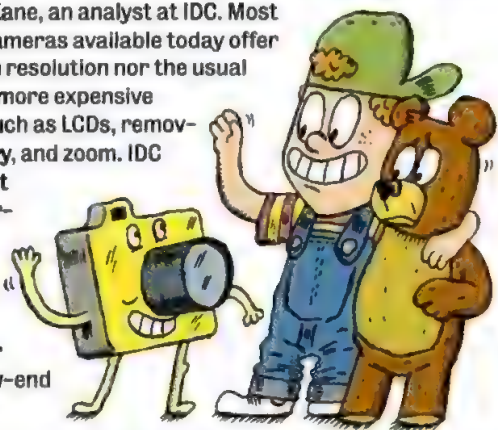
year. You can download the utility at www.babylon.com. If you don't want to load the 12MB utility, you can use it on the Web. Babylon.com is working with Web sites to make a version of the software, called BabyloNet, available for international visitors. It recently struck a deal with *The New York Times* to provide instant-translation services for the newspaper's international readers.

Cameras for Kiddies

The popularity of digital cameras just keeps on soaring, according to market research firm IDC, which expects the worldwide market for entry-level adult digital cameras priced under \$150 to increase from 950,000 units in 1999 to 5.7 million in 2003. Analysts expect even greater growth in the kids' market for toy digital cameras.

The success of such products as the Mattel Barbie Digital Camera has inspired a whole generation of kids who are getting digital cameras of their own. From 1999 to 2003, worldwide sales of toy digital cameras priced lower than \$70 are expected to increase from 1.9 million units to 17.5 million.

What's driving the growth? Simplicity, say industry watchers. "The cameras in these developing segments are less expensive and easier to use than traditional digital cameras," says Kevin Kane, an analyst at IDC. Most of the toy cameras available today offer neither high resolution nor the usual features of more expensive cameras, such as LCDs, removable memory, and zoom. IDC expects that manufacturers will soon begin to add extra features for even the low-end cameras.



Wharton's New Business Plan

Web-based applications are opening up a whole new competitive landscape in the software business. Now even The Wharton School has become an application service provider.

The University of Pennsylvania business school's IT department originally developed a data-mining application called WRDS (Wharton Research Data Services) for the Wharton faculty, but it's now licensing WRDS to other business schools for access over the Web. WRDS includes 200GB of financial information on companies, banks, government bonds, and stock exchanges, all dating back to 1946.

Wharton's business plan doesn't stop there. It recently began licensing its technology that lets students and faculty collaborate, known as WebCafe. This is based on Instinctive Technology's eRoom, a Web application for project collaboration.



THIS ISSUE'S CONTRIBUTORS: Carol Levin, Sharon Nash, and Sebastian Rupley.

IBM's 73GB Hard Disk

Last year, IBM was thinking small when it delivered the world's tiniest hard disk: the matchbook-size IBM microdrive. Now IBM is thinking big, really big, with its 73GB hard disk, the highest-capacity hard disk so far.



The IBM Ultrastar 36LZX is a paperback-size disk that packs 7.04 billion bits per square inch—enough space for a floor of books at the New York Public Library. IBM researchers have developed *active damping*, a technology that enables disks to deal with temperature variations and vibrations, which can cause problems as storage capacity increases.

IBM designed the disk for applications such as music recording, video editing, and credit card transaction processing.

But why stop at 73GB? IBM researchers recently set a world record of 35.3 billion data bits per square inch. IBM says this breakthrough could lead to disks that offer triple the capacity of hard disks today.

Top-Selling PC Games

1	Microsoft Age of Empires II: Age of Kings	Microsoft
2	Tom Clancy's Rainbow Six: Rogue Spear	Red Storm Entertainment
3	Command & Conquer 2: Tiberian Sun	Electronic Arts
4	Cabela's Big Game Hunter 3	Activision
5	Deer Hunter III	GT Interactive
6	Deer Avenger	Havas Interactive
7	Tom Clancy's Rainbow Six Gold Edition	Red Storm Entertainment
8	Starcraft	Havas Interactive
9	Homeworld	Havas Interactive
10	Monopoly Game	Hasbro Interactive

Source: PC Data, week of October 3-9, 1999.

Hunting Pirates

The music industry is taking aim at allegedly illegal music files posted on the Internet. In a global antipiracy effort, the International Federation of the Phonographic Industry (IFPI) says that it is implementing legal actions designed to shut down sites offering illegal music files. The IFPI is also pursuing global copyright legislation. According to the IFPI, there are over 1 million illegal music files on the Internet, consisting primarily of illegal MP3 files.

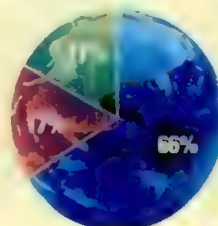
Sunny Outlook for Global E-Commerce

Consumer e-commerce spending is expected to increase twelvefold by the end of 2003, with the European market picking up significantly. European expenditures are expected to rise to 30 percent of worldwide spending by 2003.

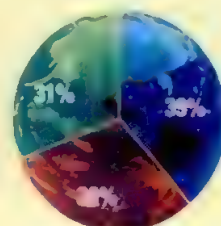
Worldwide revenues: \$31.2 billion

\$380.5 billion

- U.S.
- Europe
- Other



1999



2003

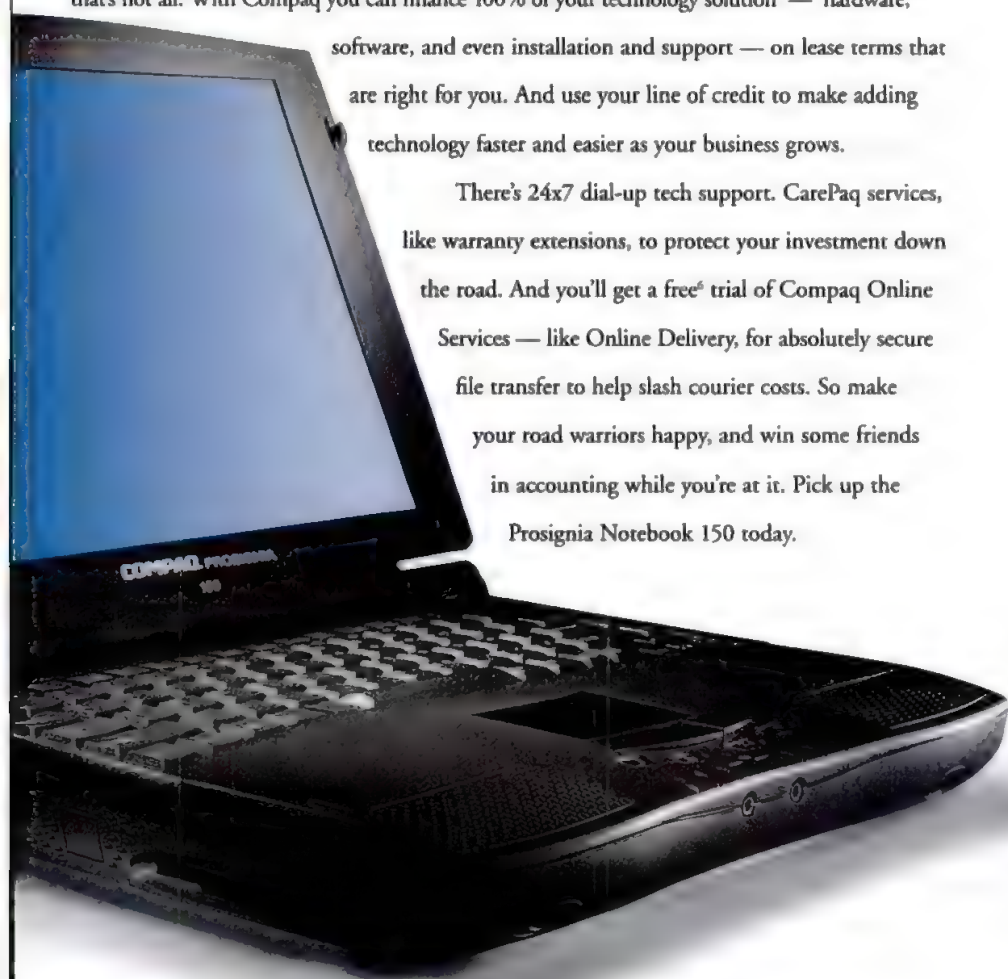
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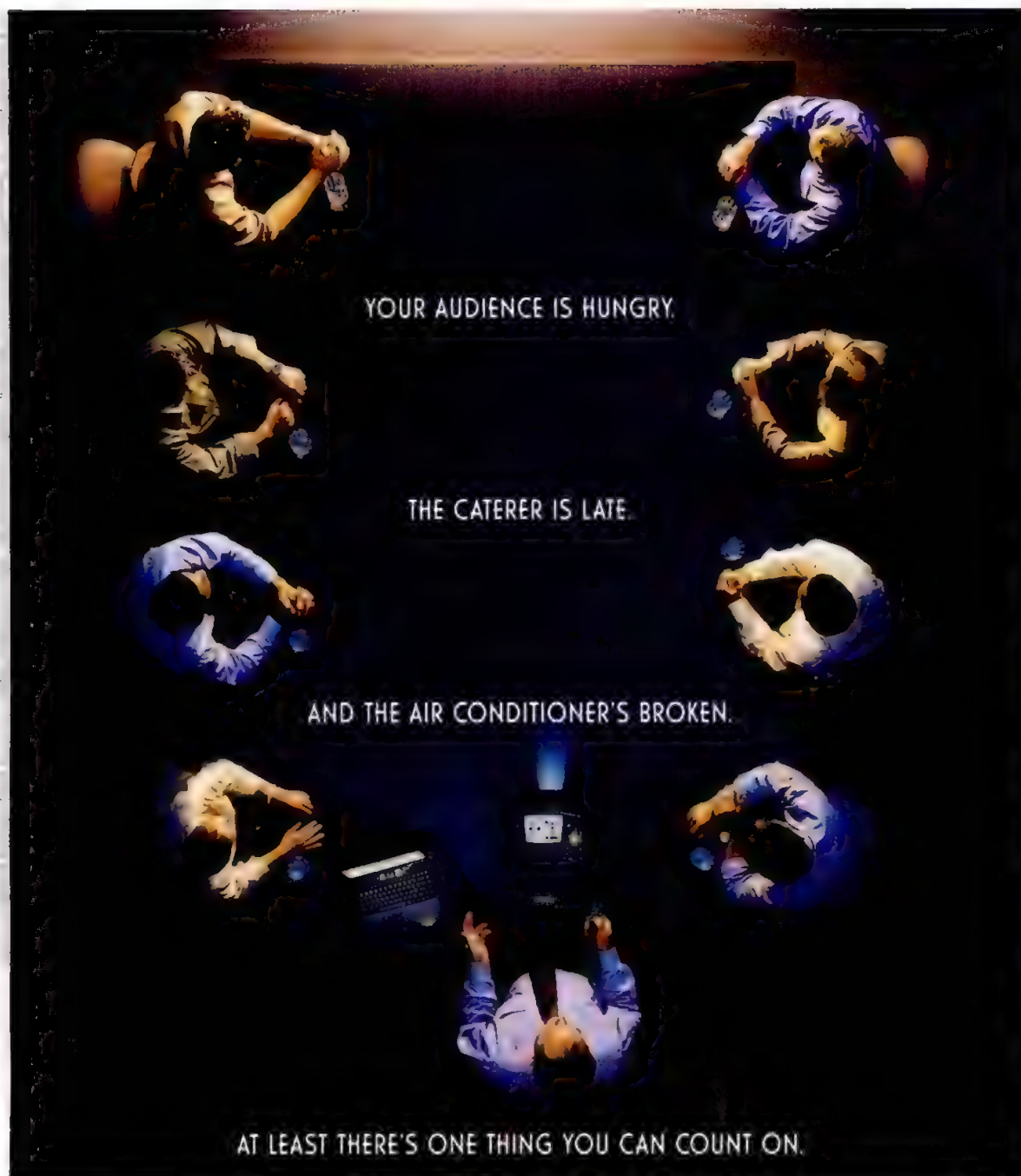
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LETTERS

NO SENSE OF SECURITY

I was dismayed that in your cover story "Send Out for Software" (November 2) no mention was made of security implications. Some of the screen shots seemed to indicate SSL-protected connections, while others did not. I'm not a "sky is falling" kind of guy, but I would think twice about being the one to throw out your software and then have to explain how the competition or CNN got your boss's secret memos.

ALAN MEAD
via the Internet

TAKING PRINTERS PERSONALLY

I was disappointed that you excluded photo printers from your story "Personal Printers" (November 2). I bought an Epson Stylus Color 700 ten months ago, and it's already obsolete. Some specialty stores, but not many, now carry the Epson Stylus Photo 750 (the latest model), and finding a store that carries ink cartridges for the 700 is getting harder every day. If a printer manufacturer wants to build a loyal clientele, it should give customers the opportunity to trade up if their printers are replaced by new models within a year of the date of purchase.

GORDON L. FROEDE
Cheviot Hills, California

Thank you. It's about time somebody did a "click to clunk" printer speed test. I've got a brand-new Xerox XD100 laser printer/copier combo, which has a prominent sticker that says "8 ppm." To meet the minimum requirements, the manual says you need a 66-MHz 486. I have a 133-MHz 486 with 48MB of RAM, and guess what? I can get 4 ppm only by degrading to 300 dpi, turning the print manager off, and doing other software tricks.

The big secret is that the XD100 really takes a hopped-up Pentium II to hit 8 ppm. Saying "8 ppm" is one thing, but at least be honest about the minimum hardware requirements to get this speed.

CLAYTON CHINN
via the Internet

You recently reviewed printers (November 2) and Scanners ("Scanning Made Simple," September 1). In both cases, the quality of the image is important to the buyer, but you no longer publish images captured or printed from these peripherals. All the testing you do is valuable, and your opinions on the image quality are nice to read, but I want to form my own opinions of the images produced by a scanner or printer. I can't believe you stopped doing this most valuable part of the reviews.

JOHN BALDI
via the Internet

You can see scanner output side by side in an online comparison on our Web site. The online presentation of our latest printer evaluations lets

"I would think twice about throwing out your software."

you test your own printer using the same tests that we use at PC Magazine Labs.—Ed.



BLAZING THE TRAIL

Your November 2 Trends article "Will USB Finally Have Its Day?" mentioned everything except the real reason USB has finally taken off this year. The introduction of the Apple iMac with USB connectivity was seen at first to be kind of foolish, but the huge popularity of the iMac is what has spurred the growth of USB peripherals. And Apple is about to do it again: Your comment that IEEE 1394 (FireWire, invented by Apple) hasn't had the same impact as USB is about to be proved wrong, too, with the introduction of FireWire-based iMacs.

TOM VOIGHT
Huntsville, Alabama

LONG LIVE MY BATTERIES

I'm sure "A Snapshot Look at Battery Life" (Inside PC Labs, November 2) was informative for many who have digital cameras and are frustrated by the poor life of batteries, but why didn't you include rechargeable double-A nickel hydride batteries in your tests?

I have owned digital cameras since they first appeared on the market, and I was constantly frustrated by using a set of four double-A batteries every 15 shots. Then I found nickel hydride batteries, which let me take 100 or more shots with the flash and LCD viewer on. A set of four and a charger

should cost around \$20, and the batteries are rechargeable up to 500 times.

WESLEY A. KNAPP
via the Internet

TAILS FROM THE ROAD

In the November 2 Letters column, Gary Zeune writes that he decided against installing RoadRunner for fast Internet access and chose to stick with his slower ISP, Mindspring, because of his travels. Well, I also do a lot of traveling, and I have RoadRunner. I installed the free Internet service Netzero on my laptop and use it on the road. When you're

connected to Netzero, you can get your RoadRunner mail while you're on the road. Sure, Netzero might put banner ads on your screen while you surf, but I put up with that, knowing I'll have a fast connection when I get home.

BILL WARE
Cincinnati, OH

FEED THE FIRE

In Bill Machrone's excellent column "Forget 1394; It's HPSB Now" (November 2),

he mentions FireWire's peer-to-peer capabilities in passing while musing over the many possible reasons IEEE 1394 (FireWire) hasn't become more popular. Does anyone really think Intel wants to enable a bus technology that's peer-to-peer? Why would Intel want to push any technology that isn't processor-centric? Apple isn't in the processor business, and therefore you see 1394 on all its machines. Machrone asks the question about adoption of 1394 on the PC but never arrives at the real reason: With 1394, you don't need that Pentium, that Celeron, or that Merced to do the job.

MATT SCHULTZ
via the Internet

OLD-SCHOOL ACCESS

Jim Seymour writes in his November 2 column ("Ready for Web Apps?") that "no company would consider giving you access to its corporate data assets from off the premises, even if it were possible to tote one of those clumsy terminals home and find some way to connect it remotely." Not true.

I worked as a scientific software engineer in a large aerospace company from 1956 until 1995. Beginning about 1980, I was able to access IBM mainframes via the TSO time-sharing system from my home using a modem and my Radio Shack TRS-80 Model III personal computer.

Yes, at work I did access the mainframes

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- Slots: (5) PCI (2) ISA (1) AGP BX chipset

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- (1) Channel RAID Q/S
- Sony DVD CD-ROM
- Soundblaster Live
- Subwoofer Speakers
- Diamond 7770 Ultra 32MB AGP
- Sony CD Recorder Rewritable
- Keyboard Floppy Mouse
- Mid Tower Chassis

3517

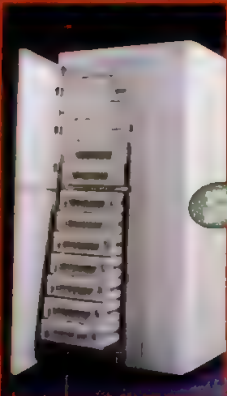
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- Integrated 10/100 Ethernet
- Integrated 2MB Video
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NEW! DUAL PIII CPU & VIDEO

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- 256MB Cache, 133MHz Bus
- Upgradeable to 2 CPUs
- 256MB ECC SDRAM Upgradeable to 4GB
- Slots: (2) 64bit PCI (3) 32bit PCI (1) AGP Pro

- 16 MB Video
- 4 Channel Ultra 2 64bit RAID
- Q: (3) IBM 9GB LVD 10,000RPM Remov. HD
- 40X CDROM/Max, Keyboard, Floppy
- Intel 10/100 Ethernet
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13 Bay Rackmount Solution Available

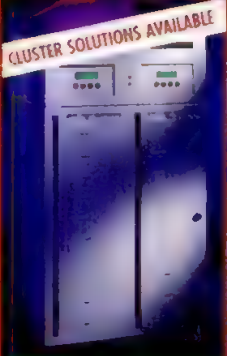
NEW! DUAL PIII CPU

- (1) Intel Pentium III 450MHz Processor
- 512KB Cache, Expandable to 2 CPUs
- 128MB ECC Memory, Expandable to 1GB
- Slots: (4) 33MHz PCI (2) 66MHz PCI 6X Chipset

- Integrated Adapter Ultra2 LVD SCSI
- Integrated 10/100 Ethernet
- Integrated 2MB Video
- 9GB LVD 7200RPM Remov. HD
- Sony 40X CD-ROM/Max
- Keyboard Floppy Mouse
- Full Tower 300 Watt
- Intel Server Control Manager Software

1550

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NEW! STC 10 DAY

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- 10 Hot-Swappable Drive Bays
- Redundant Power Supplies
- 16MB Cache

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- Power Supply Status
- Cooling Fan Status
- Visual and Audible Alarm

Q: (3) 36GB 10,000RPM LVD HD **10,200**

Q: (3) 8GB 10,000RPM 15.0ms LVD HD **7928**

Q: (3) 9GB 10,000RPM 15.0ms LVD HD **6458**

STC 20 DAY

- Active, Active Controllers
- Q: (2) 4 Channel RAID 5 U2W Controllers
- 8 - 230 Watt Hot Redundant Power Supplies
- 128MB of Cache

Internal Temperature Status

- Power Supply Status
- Cooling Fan Status
- Visual and Audible Alarm

72GB Solution

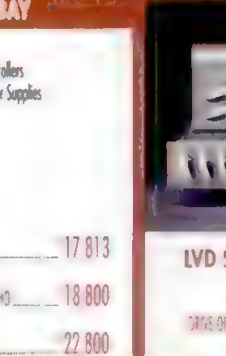
Q: (8) 9 1GB 7200RPM LVD HD **17,813**

72GB Solution

Q: (8) 9GB 10,000RPM 15.0ms LVD HD **18,800**

144GB Solution

Q: (8) 8GB 10,000RPM LVD HD **22,800**



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SAGE
ELECTRONICS

from one of those dumb green-screened VTAM terminals that Seymour mentions in his column. My permitted access to company files on my TRS-80 at home was identical to the VTAM access in the company office.

Before the late 1960s, mainframe computing access was via punched cards only. From then on, time-sharing access was available—at first via a terminal that looked like a teletype machine at 30 bps, then via an IBM terminal that looked like an IBM electric typewriter. GUIs came along later—but in the beginning, time sharing was strictly line by line.

AL HROMIAK
via the Internet

THE TRUTH IS OUT THERE

John C. Dvorak's November 2 column on Microsoft's plan to sink the whole free-mail industry by first sabotaging its own MSN Hotmail service ("Microsoft's Dastardly Plot") is unreal. It reads like an episode of "The X-Files." Microsoft has had enough bad press in the last year without purposely creating more for itself. I have my own reservations about its practices, but I doubt self-destruction is one of those practices.

We are led by Dvorak to believe that Microsoft's marketing ghouls are brilliant enough to come up with a plan to destroy one of its more successful online ventures and take the competition with it. Leaving what? Is it trying to get everyone to implement Exchange?

If anything, Microsoft is trying to expand the reach of Hotmail. It now has its own messenger service—compatible with AOL's Instant Messenger—which requires having a Hotmail account.

MARK MORGAN
via the Internet

CHECK IT OUT

In the November 2 Solutions section (page 248), Austin Gean says that he had accidentally unchecked the "Always ask before opening this type of file" box when he was downloading a ZIP file. Thanks for the information on how to restore this. I had unchecked this box too, but I found a simple workaround.

Since I have WinZip installed, the ZIP files that I download are opened in WinZip. This was annoying, until I clicked on File in the pull-down menu and found a Move command. Essentially, it works like a Save As command. Now I can check out the contents of the ZIP file before I save the file to the temporary directory where I place all the new stuff I acquire off the Net.

GARY
via the Internet

BREAK IT DOWN

Reader Eli Twok asks if there is a way to pause and resume Web downloads (Solutions,

Corrections and Amplifications

Since their publication in Jake Kirchner's column "A Rejuvenated Compaq" (October 5, page 30), the preliminary IDC figures for the Compaq and Dell shares of the PC market in the second quarter of 1999 have been updated. The final numbers show that Compaq accounted for 18.5 percent of U.S. PC shipments and 14.4 percent of worldwide shipments; Dell's numbers are 16.6 percent for the U.S. and 14.3 percent worldwide.

In our November 2 Trends story "Thin Clients Make a Comeback" (page 36), we stated that IBM has a new line of eight thin clients called the Network Station Family. We said that they run on National Semiconductor processors. An IBM spokesperson informed us that although the Series 2200 uses a National Semiconductor Geode GXLV-233 chip, the Series 300 and Series 1000 have PowerPC processors, and the Series 2800 uses a 266-MHz Intel Pentium MMX chip.

In our November 2 cover story "Send Out for Software" (page 108), we incorrectly stated the price of NetLedge; the correct price is \$4.95 per month for 1,000 transactions.

In our November 16 First Looks story "Virtual Desktop Services," we incorrectly listed the additional-pay services for Visto. Optional services for Visto are telephone information retrieval (\$0.15 per minute after the first 10 minutes per month), telephone conferencing from AT&T Click2Dial (\$0.15 per minute per participant, anywhere in the U.S.), and additional file storage space (\$25 per year for a 25MB block).

November 2, page 248). You talk about some shareware programs for "less than \$20." I can't believe you didn't suggest Netscape SmartDownload, which is free and easily downloadable for Netscape users.

JOHN BALDI
via the Internet

SPEED MACHINE

Your October 19 First Looks review of the emachines eOne ("Separated at Birth?") has one omission. You didn't compare the power of the eOne's Celeron processor with the iMac's G3 processor. I believe the G3 is a processor on a par with the Pentium III—or at least with the Pentium II.

DAVE
via the Internet

SLICK SOLUTION

The TreePrint Utility in the October 19 Solutions section has to be the slickest solution to the Windows directory printing issue that I have seen. The right-click interface from Windows Explorer and the options to save or print, to set the subfolder level, to include or exclude filenames, and to choose the editor that's used are all well implemented.

BILL SHARPE
via the Internet

CHIEF EXTERMINATING OFFICER

Since John C. Dvorak recommended our product, DiskJockey 98 (Inside Track, July), we have gotten many new customers. In a recent letter you published (October 5), reader John Gruener wrote that his demo version of DiskJockey 98 was buggy and that it deleted some files on his system. Does DiskJockey 98 have bugs? Sure. Only a fool of a programmer would claim bug-free code.

Okay, all software has bugs, but I agree that deleting files is inexcusable. When this updated version of DJ is viewing files with hyperlinks, clicking on a hyperlink will cause the hyperlinked file to get deleted (yikes!). This bug is not in the shipping CD-ROM version

of DJ. The bug did, however, work its way into an update distributed on our Web site, and it got into the demo (both have since been replaced with corrected code). What about the report of other bugs? Guilty again, but also fixed again.

I like to believe that the measure of a good product is a combination of its functions and the support behind it. Since DiskJockey 98 became available in May 1998, we've released three free updates that fixed bugs, updated the viewers, and added features requested by customers. Our latest update has been extensively tested on six different releases of Windows. Does it have any bugs? As of this writing, we aren't aware of any, but we welcome you to search.

TONY PEREIRA
President, Clear & Simple Inc.
West Simsbury, Connecticut

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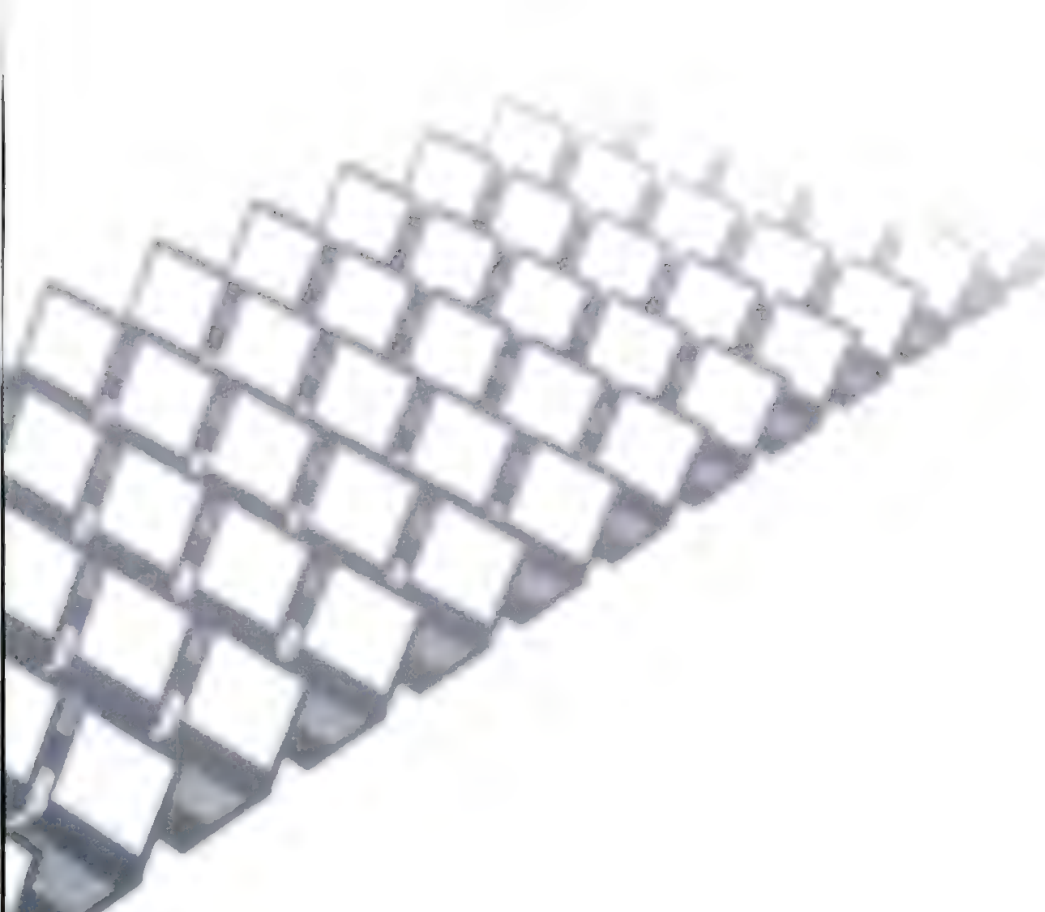
PC Computing Magazine



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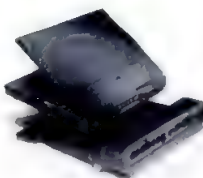
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Calling the Web

Smart phones get smarter.

Soon, your average cellular phone just might be a Web phone. A handful of new smart mobile phones with Internet browsers are on the way, underscoring an industry-wide push toward convergence among all kinds of computing technologies and the cellular phone.

Upcoming offerings from Motorola, Neopoint, Nokia, Qualcomm, and Samsung come in various sizes and are based on various operating systems. Wireless Internet access on the whole—especially through smart phones—may grow much faster than wired Internet connections. US West CEO Sol Trujillo recently predicted that more than 1 billion people will connect to the Internet by 2002, with at least 750 million connecting wirelessly and on a daily basis. He added that far more people sign up for new cellular phone service each day than sign up for Internet access. According to Dataquest, mobile phone sales in the U.S. surpassed 10.3 million units in the second quarter of this year.

The race is on to deliver the right operating system and software for smart phones. Microsoft has produced a prototype Windows CE-based smart phone with a built-in browser and color display. CEO Bill Gates recently demonstrated the phone connecting wirelessly to the Web at the Telecom 99 conference in Geneva. Gates said there that his company is increasingly focusing on smart phones and other non-PC devices, a policy furthered by

several recent ventures. Microsoft has partnered with British Telecommunications (BT) to develop Windows CE-based wireless devices, and has also acquired a British software company called STNC Enterprises, which is developing a microbrowser. A public trial of the BT and Microsoft technology is currently underway using phones from Sagem and Samsung.

In another move to put smart phones on the fast track, 3Com is licensing its Palm operating system to cell phone manufacturers, including Qualcomm. But 3Com may gradually move away from its Palm operating system. 3Com recently partnered with Symbian, a consortium comprised of Ericsson, Matsushita, Motorola, Nokia, and Psion, to produce Web-connected smart phones that use Symbian's EPOC operating system.

As a first step, Nokia plans to develop Internet phones that use pens and touch-sensitive screens similar to 3Com's Palm devices but with the EPOC operating system. Another Windows CE competitor, Geoworks, is licensing its GEOS operating system to Nokia for other smart phones. Nokia is the market-share leader in mobile phones, according to Dataquest.

The range of designs and features in cell phones is expanding rapidly, with some state-of-the-art smart phones already appearing and others due in the coming months. These phones

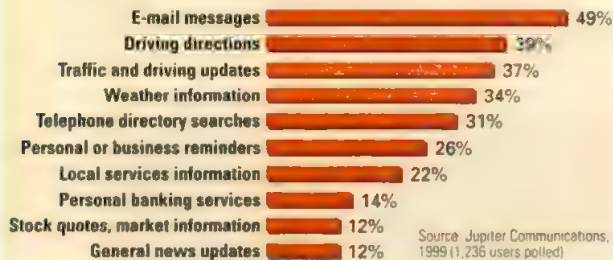


will offer many new and enhanced features, including online shopping, e-mail, and instant messaging. America Online, InfoSpace, and Microsoft all have their eyes on instant-messaging applications for cell phones.

Motorola has been exploring the idea of integrating the Mobile Organizer technology it acquired along with Starfish Software into its cell phones. Available now, Motorola's i1000 Plus SmartPhone combines organizer features with pager, fax, and Internet browsing capabilities. Qualcomm's PDQ1900 is a much bigger smart phone that features a large display and a built-in Palm operating system; you can add thousands of downloadable software applications. Neopoint's NP1000 dual-band phone has a large screen and includes a data cable and connection software kit that lets you use the phone as a modem and synchronize its data with desktop PIM software. Qualcomm, Samsung, and TouchPoint also currently sell less-expensive dual-band phones that can access the Web. NTT and Samsung have also developed *watch phones*, building cell phone technology into wrist-watches.—Sebastian Rupley

Mobile Choices

E-mail is the favorite activity for users of Internet-enabled portable devices, according to Jupiter Communications. But Jupiter expects that accessing driving and weather information will eventually become more popular.



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Intel's Coppermine Onslaught

Intel recently added 15 new microprocessors to its lineup, including Pentium III processors that are based on the new 0.18-micron process technology and code-named Coppermine. Increases in bus bandwidth, improvements in caching technology, and new approaches to system buffering are all ways in which Intel is trying to boost simple processing speed.

Among the newcomers are three mobile Pentium III 0.18-micron processors running at 400 MHz, 450 MHz, and 500 MHz. Of those, the 400-MHz Mobile Pentium III chip is designed to operate at 1.35 volts, whereas the other mobile chips will operate at slightly higher voltages. Each of the three new mobile chips features a 100-MHz system bus—a 50 percent increase in bus bandwidth over the current Intel Pentium II notebook chips.

Intel also announced three new Xeon chips for workstations and servers: one each at 600 MHz, 667 MHz, and 733 MHz. Each of these new chips has a 133-MHz bus speed and new system-buffering technology.

Most of the new Pentium III chips are aimed at different desktop PC market segments. There are nine new desktop chips with a broader range of clock speeds and bus specifications than is found in the new mobile and workstation chips. The new desktop chips range in clock speeds from 500 MHz to 733 MHz.

AMD recently unveiled its new 700-MHz Athlon chip, priced at \$849 in volume, but has subsequently considered dropping the price. The highest-end workstation processor Intel announced was the 733-MHz Xeon, with a 133-MHz bus speed, priced at \$826 in volume. Another new desktop 733-MHz Pentium III processor with a 133-MHz bus speed is priced at \$776 in volume.

In the coming months, look for 733-MHz and 700-MHz desktop systems based on Intel and AMD processors to be carrying prices around \$2,000.—*Sebastian Rupley*

Coppermine Speed Leaders

These five new chips are Intel's fastest in several categories

Desktop	Bus speed
Pentium III/733	133 MHz
Pentium III/700	100 MHz
Pentium III/667	133 MHz
Workstation/server	
Pentium III Xeon/733	133 MHz
Mobile	
Mobile Pentium III/500	100 MHz

Source: Intel Corp.



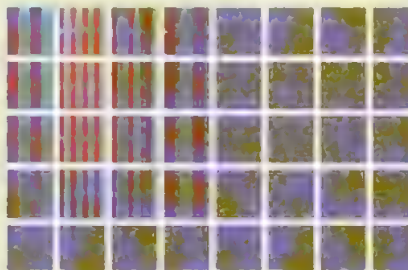
Graphics Cards Shape Up



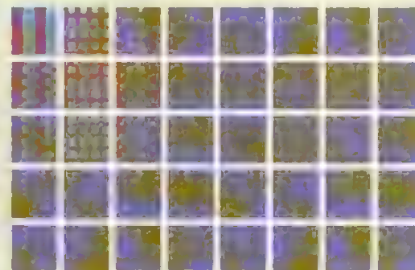
During PC Magazine Labs' testing for our latest evaluation of 3-D graphics cards (which will appear in our next issue and is now online at www.pcmag.com), we found that benchmark test cheating isn't as widespread as it was last year, when many vendors claimed that rendering shortcuts were "performance optimizations." We considered them "benchmark test cheats."

Most of the cards we evaluated offered huge leaps in performance, but our new benchmark program 3D WinBench 2000 did expose questionable rendering techniques. Some were bugs, and others were genuine performance enhancements. Still others may have been cheats.

To run our new 3-D tests most efficiently,



The left image shows proper trilinear filtering—a key feature in 3-D graphics cards. The 3dfx Voodoo3 3500 TV doesn't do this properly when multitexturing but falls back to dithering (right), which is less taxing. It also uses a smaller texture map, which could speed performance.



we requested that the cards allow us to turn off v-sync via the DDFLIP_NOVSYNC parameter of the DirectX Flip call. Only the Creative Labs 3D Blaster Annihilator (based on the nVidia GeForce 256), the VideoLogic Neon 250, and the Matrox cards supported the call properly. We tested these cards with double buffering and with v-sync disabled. We tested the remaining cards with triple buffering and with v-sync enabled. The triple-buffered group wasn't noticeably limited in frame rate, because most 3D WinBench 2000 scenes are complex and don't operate at high frame rates.

The Annihilator was the only card that properly supported DirectX 6 texture compression (S3TC or DXTn). Since S3 developed S3TC, we were surprised that the Diamond Stealth cards—based on the S3 chips—didn't fully support S3TC compression. We expect that S3/Diamond cards will fully support compressed textures soon.

We also detected mipmapping problems with the ATI RAGE Fury Pro, both Diamond cards, both 3dfx Voodoo3 cards, the 3DLabs

Permedia3 Create!, and the VideoLogic Neon 250. (Mipmaps are copies of texture bitmaps stored at various resolutions.)

We had to perform a trilinear mipmapping filtering failure override to get an older, nVidia Riva TNT2 Ultra-based Diamond Viper V770 Ultra to run one of our 3-D scenes that performs trilinear filtering. (Bilinear filtering averages four separate texture elements, or texels, within a single mipmapping level to produce a single texel value. Trilinear filtering averages the results of two bilinear-filtered texels from two adjacent mipmaps to produce a single texel value to apply to a pixel.) The Viper V770 Ultra didn't perform true trilinear filtering in the presence of multitexturing operations; it resorted to dithering.

Both 3dfx Voodoo3 cards also fell back

to dithering and used a lower-quality mipmapping when requested to perform trilinear filtering concurrent with multitexturing (as shown here). Both of these "optimizations" reduce texture memory bandwidth.

Many of the cards purposefully queued multiple frames, which can result in frame playback that is out of sync. You could have turned a corner in a 3-D game and been shot by an enemy before you even saw the frames correlating to the action. The Diamond Stealth III S540 queued over 1 second of frames at a resolution of 1,024 by 768 and 7 seconds at 1,600 by 1,200.

Finally, we found that the Creative Labs 3D Blaster Annihilator board (which includes hardware transform and lighting) provided only 3 to 4 bits of accuracy for its hardware-calculated spotlight. Software-calculated lighting used on all the other boards provided at least 6 bits of accuracy. (Lighting here involves computing distances between light sources, objects, and the viewer.)—*Nick Stam and Dave Morey*

INTERNET

Free ISP Accounts

The business of free ISP accounts appears to be booming, with 1.5 million subscribers in the U.S. and significant growth expected over the next few years, according to market research firm Jupiter Communications. But how many of these subscribers actually use their free services? "The number of free ISP accounts will definitely skyrocket, but active use will be a different story. As with free e-mail, you can sign up for lots of them but you don't have to use them every day," says Zia Daniell Wigder, an analyst at Jupiter. As a result, subscribers aren't loyal to any single free ISP, which undermines the advertising-based revenue model.

Meanwhile, the free ISP market in Europe is facing a similar situation, complicated by a different way of doing business. Unlike subscribers in the U.S., who pay flat rates for local

phone calls, subscribers in Europe pay metered—and higher—rates for local calls. As a result, Europeans have been reluctant to pay for monthly subscriptions to ISPs on top of their already high local phone bills. So the phone companies pay ISPs a percentage of the revenues from the phone calls made to access the Internet. This business model enables free ISPs to flourish in Europe.

This approach, however, is threatened by the trend in Europe toward flat-rate local calls. "As dial-up prices decrease, ISPs will be forced to look elsewhere for revenue," says James Eibisch, research manager at International Data Corp. He adds that the free ISPs in Europe will have to look to advertising and other services such as online banking, shopping, or stock trading to compensate.

As far as the U.K. goes, Eibisch says deals that combine cheaper phone rates with fee-based subscriptions also have a good chance of taking off. For instance, AOL has implemented



a successful monthly subscription and cheaper-phone-rate program in the U.K.: It recently announced a plan for charging users only 1.6 cents a minute regardless of the time of day, which saves customers from the higher rates of regular U.K. calls. British Telecommunications is also offering free weekend calls as well as a free ISP service with regular phone rates. The current leader in the U.K. market is Freeserve, a free ISP with 1.6 million users that's offered by British retailer Dixons.—Sharon Nash

Buying a New PC Is Getting Harder, Not Easier



Jake Kirchner

Looking for a great deal on a PC this season? My advice is to look carefully, because despite the common wisdom that it doesn't matter which PC you get as long as you get a good price, the truth is that it's getting harder, not easier, to find the right PC for you. There are more machines and a greater variety of components than ever, meaning there's a growing number of critical decisions you have to make when you shop.

I'm surprised each time I read that it's easy to buy a PC today. Just hunt down the lowest possible price, because all you really want is to get on the Internet, right? Just try taking that approach to the store or the Web when you're in the buying mode. Because I've had to shop for two PCs in as many months—one for our daughter's college dorm room and one for our home—I can tell you that you're in for a shock if you take that "it doesn't matter" approach to the market.

For a taste of today's PC-buying challenges, check out the Web site of ABS Computer Technology (www.buyabs.com). It's a good place to start your buying adventure, because it makes you realize how much—or how little—you really know about PCs. Unlike IBM (www.ibm.com/shop) and some other buying sites, which present a limited number of featured systems that you can customize a bit, ABS presents a sometimes bewildering array of choices. That's great if you know what you're doing, but daunting otherwise.

With any purchase, you're expected to pick a processor and decide on how much memory and disk space

you'll need. At ABS, however, you get to choose among three motherboards as well. You also have to pick from among half a dozen each of various hard disks, CD-ROM or DVD drives, and video cards, not to mention a dozen monitors. And yes, it does make a difference what you choose; your DVD drive, video card, and monitor options should be coordinated, for instance. And we haven't even gotten to sound cards and speakers, which make a big difference in the quality and price of the system you end up with. Don't forget modems, network cards, keyboards, and mice. Decisions, decisions.

Of course, you can always just ask a PC vendor—retail or online—to recommend a good system for your price range. But is buying on price alone really effective? Not always.

I've dropped more than my share of money at Dell's very efficient online store (www.dell.com) and never been unhappy with what I got. But recently, I priced absolutely identical 500-MHz Pentium III-based Dimension systems at both Dell's Home Systems and Small Business Center shopping sites. The price at the business site was \$1,684, and the price at the home site was \$1,879. I dialed Dell's 800 number and spoke with one of the Home sales reps, who acknowledged that "with certain configurations, sometimes they're able to get a better price over there [at the business site]."

You can get a good computer and a good deal at any of these sites, and every large vendor has multiple business units with different pricing policies and options. That just accentuates the need to be an educated buyer. You need to stay on top the technology, ask a lot of questions, and shop around very carefully, because it really does make a difference. Anyone who tells you "it doesn't matter" doesn't know.

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INTERNET

Spam in the Crosshairs

Sick of junk e-mail? You're not alone. The increase in spam-blocking software titles is being accompanied by legislative efforts to deter spammers. In October, the House of Representatives considered a bill that would let you submit your name to a national database of individuals who don't want to receive unsolicited e-mail. Another bill would outlaw such e-mail altogether. Several states have already enacted antispam bills, and Internet service providers have also taken aggressive steps toward curbing spammers.

Under the provisions of the Unsolicited Electronic Mail Act, which is sponsored by Rep. Heather Wilson (R-N.M.), those who choose to have their names on the list (and who have been on the list for 30 days) could sue accused spammers for \$500 per single unsolicited e-mail sent to them. The Federal Communications Commission would maintain the list and would be empowered to impose fines on known spammers who have been ordered to stop.

Given the amount of spam sent by many bulk e-mailers, such fines and suits could have bank-busting implications. Are these measures justified? Consider this statement from

Vint Cerf, widely acknowledged to be the "Father of the Internet": "Spamming is the scourge of electronic mail and newsgroups on the Internet. It can seriously interfere with the operation of public services, to say nothing of the effect it may have on any individual's e-mail system. Spammers are, in effect, taking resources away from users and service suppliers without compensation and without authorization."

Another bill that the House Committee on Commerce is evaluating seeks to ban spam altogether. H.R. 2162 (also known as the Can Spam Act), sponsored by Rep. Gary Miller (R-Calif.), would make any transmission of unsolicited material illegal. As such, it faces some tough questions about implementation, as well as serious opposition from many Internet marketers.

At the state level, many antispam bills have already been enacted, and their stipulations vary widely. For example, Maryland prohibits the use of e-mail with intent to harass but doesn't restrict "peaceable activity intended to express political views or provide information to others."

In an injunction recently brought against an individual in the state of Washington under



the state's Unsolicited Electronic Mail Act, the state sought damages of \$2,000 per single piece of spam sent. The injunction accused the individual of sending 100,000 to 1 million unsolicited e-mails per week. The injunction cited several infringements of the state's act, including using subject lines that don't accurately describe the contents of a message, and using false or misleading return addresses.—*Sebastian Rupley*

COMBO DRIVES

Hybrid CD-RW/DVD-ROM Drives

So many disks, so little space. These days, most software comes on CD-ROM. Meanwhile, the ever-increasing storage capacity of hard disks makes CD-RW disks important for backup, and CD-R technology is useful for archival storage. And now DVD-ROM is becoming an important factor in software and entertainment. Wouldn't it be more efficient to have one drive handle all these formats?

The Microsoft/Intel PC 99 specification requires DVD-ROM drives as a component for home computer systems, but many users will want to use low-cost CD-R and CD-RW disks for high-capacity storage.

The problem is that the different disks have very different specifications. The laser power for CD-R and CD-RW disks must be modulated so that it is more powerful for write operations than for reading functions. The higher data density of a DVD-ROM drive requires a different laser altogether.

The longer-wavelength laser required for CD operations cannot read DVDs accurately; a shorter-wavelength laser is needed to do the job.

Toshiba and Ricoh are developing hybrid



DUO DRIVE: This hybrid read/write head combines both short- and long-wavelength lasers for DVD-ROM and CD-RW support.

drives designed to handle all these formats. They are based on existing technology and combine all the formats in a single drive. The key feature is the read/write head, which is designed to be as lightweight as possible. As the head's mass increases, it becomes more difficult to position it rapidly and accurately. As a result, average access times increase, slowing the drive's performance.

The hybrid heads contain both long- and short-wavelength lasers in a single unit; to keep the head's mass at a minimum, the two share the same optics. The result is a single drive that can read and write all CD formats and read DVD-ROM disks as well.

Both the Toshiba and Ricoh combo drives are expected to support 4X CD-RW write speeds, 24X CD-ROM read speeds, and 4X DVD-ROM read speeds. The Toshiba drive will offer 4X CD-R write speed and the Ricoh drive will offer 6X CD-R write speed. Both combo drives started shipping in November and cost less than the combined prices of separate CD-RW and DVD-ROM drives.—*Alfred Poor*



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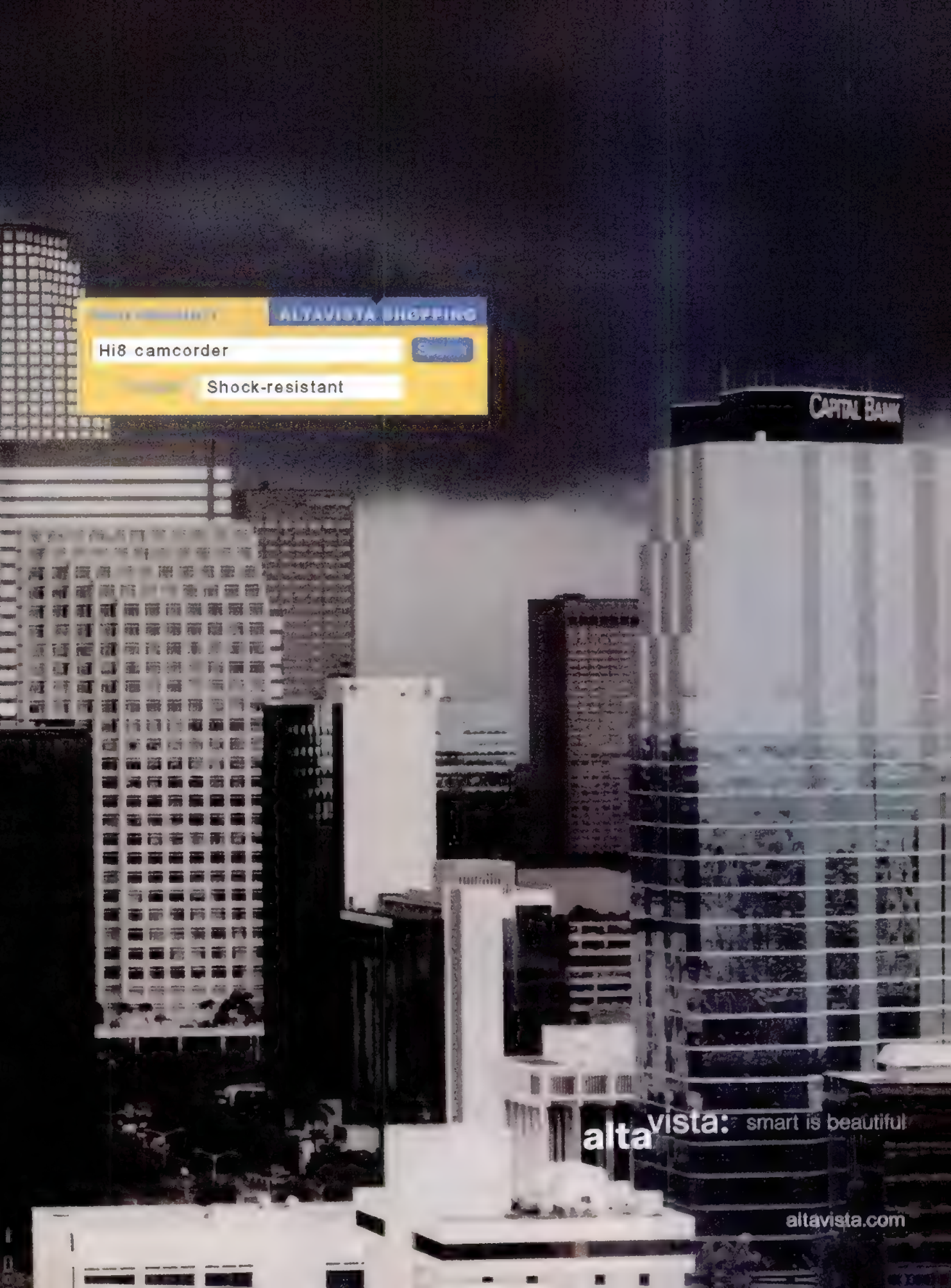
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Web Radio Days

By Matthew Graven

Streaming technologies have transformed online audio since the days when you had to wait patiently while downloading a few-seconds-long WAV file. Today, a wide selection of live radio stations is available. These range from the station that your neighbor is running from her living room to commercial radio stations. And with ever-improving technologies, streaming audio now offers better sound quality and more accessibility. With a few clicks, you can catch the latest British football scores, hear the Montreux Jazz Festival, or start your own radio station without ever leaving the warm glow of your monitor:



Tune In

➤ Since the earliest days of streaming audio on the Web, RealAudio has been the format of choice. Today, **RealPlayer G2** (www.real.com) continues to be the leading streaming media player on the Internet—with more than 80 million registered users. Microsoft's **Windows Media Player** (www.windowsmediaplayer.com), however, also accounts for a substantial number of users. Many sites now deliver content suitable for both players.

Although Nullsoft's **Winamp** (www.winamp.com) is best known for playing locally stored MP3 files, it also supports streaming audio. The underlying technology is different, but Winamp offers access to a vast network of do-it-yourself Internet radio stations.

Travel the World

➤ Thousands of Web sites have popped up that are broadcasting streaming music over the Web. But finding a station that fits your tastes can be hit or miss. **Spinner.com** (www.spinner.com) is an Internet-only radio network that offers more than 120 channels, ranging from Baroque to Brit Pop. And Internet radio stations boast some real advantages over traditional radio, such as commercial-free and DJ-free music. Check out **ChannelSeek** (<http://channelseek.com>) and **Yahoo! Broadcast** (www.broadcast.com), two multimedia hubs that highlight online-accessible events and direct you to an array of sites and stations.

Of course, traditional radio stations aren't missing out on this wave. Stations around the world are expanding their audiences by streaming their broadcast signals

over the Internet. If you can't bear another day of listening to the local morning show, **vTuner** (www.vtuner.com) is the site for you. This database of online-enabled radio stations lets you search by genre or geographical location. vTuner also rates the quality of each station and provides direct links. Similarly, **Live Radio** (www.live-radio.net) offers an extensive list, organized by region, of radio stations that broadcast online. Many of these stations, however, only support the RealPlayer format. If you're using the Windows Media Player, you can visit **WindowsMedia.com** (www.windowsmedia.com) for a listing of available stations.

Hear the News

➤ Like traditional radio, Internet radio spans more than musical genres. In fact, using the Internet to broadcast news makes it easy to access live or on-demand news reports from around the world. **National Public Radio** (www.npr.org), for instance, posts hourly news reports that you can access at your convenience. Internet newscasts also offer a global perspective that local radio stations can't. Recognizing this, NPR launched the **World Radio Network** (www.wrn.org) to deliver live news from around the world 24 hours a day.

If you're more interested in keeping up with United States news and politics, **CNN Audioselect** (www.cnn.com/audioselect) offers a variety of live news feeds, including Headline News, CNN International, and CNN en Español. Similarly, **C-SPAN** (www.c-span.org) broadcasts many of its segments, as well as C-SPAN Radio 90, via the Internet.

Be the DJ

➤ Think you can do a better job than your local radio station? Starting your own station is a lot easier—and cheaper—than you might expect. For delivering live broadcasts in RealMedia format, Real Networks offers the **Basic Server G2** (www.real.com/products/servers/basic.html), which supports as many as 25 simultaneous listeners, for free. Once you gain some popularity, however, you'll have to step up to one of the commercially available packages to accommodate more users. To produce on-demand content, **RealProducer G2** (www.real.com/products/tools/producer/index.html) is also a free download.

Shoutcast (www.shoutcast.com), another free product, integrates with Winamp to turn your computer into an Internet broadcast system. While running the server software, you can play MP3 files with Winamp. Other Winamp users on the Internet can then tune in and listen to whatever you're playing. The Shoutcast site acts as a portal, providing links to all of the servers that are currently running and listing statistics, such as how many listeners each server has.

If you'd like to dabble in Internet radio but don't want to deal with installing software, setting up a server, or spinning CDs, then check out **Imagine Radio** (www.imagineradio.com). This cookie-cutter solution lets you choose specific genres and how often songs from each are played. Imagine Radio's jukebox handles the rest. **PC**



(Top) The NPR's World Radio Network provides round the clock live news from anywhere in the world. (Bottom) Whatever song you're listening to, Spinner.com offers quick access to relevant information about it.

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Picture-Perfect Printers

Three new photo ink jet printers vary in features and price, but all of them produce great-looking prints.

By Bruce and Marge Brown

Digital photographers have new, low-cost ink jet photo printer choices. Aimed at specific markets, the Canon BJC-8200 Color Bubble Jet Photo Printer (\$400 street), the HP PhotoSmart P1100 (\$500 street), and the Kodak Personal Picture Maker PM100 by Lexmark (\$150 after rebate) each hit their target. All produce remarkable photo prints. Each printer has likable features suitable for its intended users.

All three printers have added input features, either standard or optional. The HP and Kodak units support direct digital image file printing via built-in CompactFlash and SmartMedia Card readers. The Canon unit can double as a 600-dpi color scanner by replacing the print-head with an optional scanner cartridge (\$100 street).

The HP unit has an edge, with the highest possible resolution, 2,400 by 1,200 dpi, but the results are comparable with Canon's and Lexmark's 1,200- by 1,200-dpi resolution photo prints. Unlike the Canon and HP printers, which have both parallel and USB ports, the Kodak unit does not have a USB port. Each uses its own technology to achieve high-quality photo prints, but they all reach the same destination: the capability to produce stunning output.

Canon BJC-8200 Color Bubble Jet Photo Printer

The Canon BJC-8200 Color Bubble Jet Photo Printer, with both parallel and USB ports, works well for text, color graphics, and photo printing. The unit is designed for photographers whose photo prints are over half their total print output.

Unlike previous Bubble Jet models, the BJC-8200 has a single, all-purpose printhead with six separate ink tanks in cyan, light cyan, magenta, light magenta, black, and yellow—the Canon ThinkTank System. A pop-up icon notifies you to replace only individual ink tanks (\$12 street each) as they deplete—a laudable cost-saving design. The rated yield per ink tank is 320 4- by 6-inch photos, 120 8- by 10-inch photos, 640 pages of color graphics, or 360 pages of text.

The unit's Advanced Micro-Fine Droplet Technology uses star-shaped nozzles to place an amazing 4-picoliter per ink droplet for even dot alignment at 1,200 by 1,200 dpi. New ink density technology allows the printer to produce 33 levels of color gradation for fine color shading, which is maximized on Canon's special BJ-8200 media, Photo Paper Pro (\$14 street for

PERFECT 10:

Caere Corp. adds more features and value to its popular OmniPage Pro OCR program. *Page 48.*



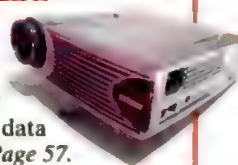
MAKE IT YOUR BUSINESS:

SmartOnline.com speeds the process of starting your own business. *Page 53.*



FEATURE-HEAVY:

InFocus packs a ton of features into its new lightweight data projector. *Page 57.*



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FIRST LOOKS

SMART PRINTING: Both the Canon BJC-8200 and the HP PhotoSmart let you bypass the PC and print from memory cards, but the PhotoSmart puts more options at your fingertips.



HP PhotoSmart P1100

This HP PhotoSmart P1100 offers the best of both worlds. It delivers high-quality photo prints from your PC or directly from memory cards. And the unit is a workhorse for everyday text and color graphics printing.

You can manage direct digital image printing from CompactFlash and SmartMedia from the printer's control panel, with no PC connection needed. The PhotoSmart also accepts infrared file transfers from digital cameras through its front-panel infrared port with HP JetSend capability.

For operation with a PC, the PhotoSmart connects via parallel or USB port. Measuring 7.25 by 17.25 by 19.0 inches (HWD)



15 sheets). Our 8- by 10-inch test photos printed at highest-quality settings reproduced with exceptionally even skin tones and realistic hues. Images were exceptionally smooth, with no banding or visible dots.

With two controls, power and resume buttons, the 11.0- by 17.5- by 21.5-inch (HWD, with all trays extended), Canon unit is simple to operate. The input tray holds up to 100 sheets of plain paper and feeds envelopes, banners, transparencies, greeting cards, and fabric transfers in sizes from legal to 4- by 4-inches.

The BJC-8200 prints in five modes: Standard for text, Super-

Photo for photos, DTP for combined text and graphics, Camera for digital images, and Draft for test prints. There are a few user-controlled image-quality settings, including adjustments for sharpness, brightness, and color balance.

You can collate your prints, construct posters, and add BMP files for full-page backgrounds—an easy way to combine graphics and text. The unit is bundled with Adobe PhotoDeluxe 3.0.

Rated speeds with USB for the BJC-8200 are under 1 minute for 4- by 6-inch photos and under 3 minutes for 8- by 10-inch photos. On our speed test with a parallel port connection, the unit took 6 minutes 30 seconds to print an 8- by 10-inch photo at the highest-quality settings on glossy photo paper.



The Canon BJC-8200 Color Bubble Jet Photo Printer produces above-average photo-quality prints with distinguishing color aspects to appeal to advanced amateur photographers, but limited software settings for fine-tuning image prints and paper-size limitations are shortcomings for photo or graphics professionals.

Canon BJC-8200 Color Bubble Jet Photo Printer. Street price: \$400. Requires: 16MB RAM; 30MB hard disk space; Microsoft Windows 95, 98, or NT 4.0 or later. Canon Computer Systems Inc., Costa Mesa, CA; 800-652-2666; www.ccsi.canon.com.

Dye-Sub Snapshot Printers

If you pay for a lot of photo processing, you might consider a dedicated digital photo printer for printing your own snapshot-size photos through dye sublimation technology. Two good options are the Acer FotoPrisa 300P (\$200 street), from Acer Peripherals America (800-379-2237, www.acerperipherals.com), and the Canon CD-300 Digital Printer (\$500 street), from Canon U.S.A. (800-852-2868, www.usa.canon.com). Both printers use one-time print ribbons and a three-pass printing process. Print quality is good for \$0.80 to \$1.00 per print—although not quite at the level of conventional film processed prints.

With a PC connection, the Acer unit prints photos on 4- by 6-inch glossy paper, postcards, and stickers. Priced for its greater functionality, the Canon unit reads images from a PC or from memory cards, and it captures single-frame video. Its

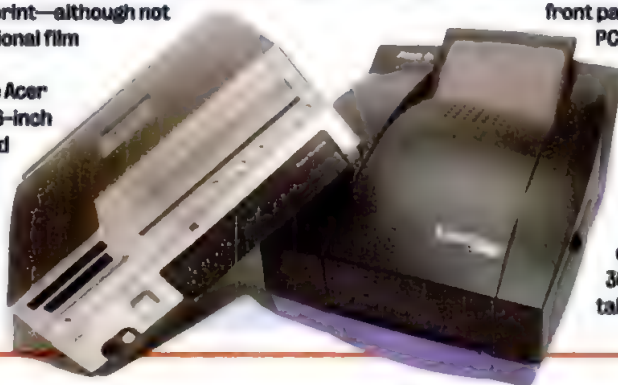
print media includes 4- by 6-inch photo paper or labels and 4- by 10-inch panorama paper.

About half the size of a standard desktop printer, the FotoPrisa 300P measures 5.5 by 9.0 by 17.0 inches (HWD, with all trays extended). Connected to a PC via a pass-through parallel port (a USB version is in development) in ECP mode, the Acer unit prints in 300- by 600-dpi resolution, which is fine for personal photo prints. Prints process in about 1 minute.

The eye-catching Canon CD-300 Digital Printer measures 3.8 by 9.5 by 15.0 inches (HWD, with all trays extended). The printer's front panel has separate slots for inserting PCMCIA Types I and II and CompactFlash Type I and II cards. There are two video-in ports, as well as a video-out port for viewing images on a TV.

In panorama printing mode, you can merge two or three images horizontally into one print.

The Canon unit prints at 300- by 300-dpi resolution. Like the Acer FotoPrisa 300P, the Canon CD-300 Digital Printer takes about 1 minute per print.



CAMERA COMPANION: With its low price, wealth of features, and great output, the Kodak Personal Picture Maker is the perfect complement to your digital camera.



with all trays extended, the unit has an Automatic Two-sided Printing Module that fits into the back of the printer, extending its depth by 2.75 inches. The PhotoSmart's front-panel controls include a power switch, an LCD status panel, and buttons to select photos from external storage media and to set the number of copies and print size.

To print 2,400- by 1,200-dpi output, HP combines its PhotoREt III Color Layering technology and a 5-picoliter ink droplet in the PhotoSmart with user adjustments for saturation, brightness, and tone. Our test photos printed with natural-looking color (with reds slightly pushed in the default setting) and sharp detail. Replacement ink cartridges start at \$20 (street) for economy black (\$.046 per page) and \$34 (street) for economy color (\$.074 per page).

The printer driver supports two quality settings, 16 paper types, and 10 paper sizes, from 3 by 3 inches to 8.5 by 14 inches. Other options include mirror prints, poster formats, multipage layouts per sheet, gray scale, and photocopy or fax optimization. The primary paper tray holds up to 100 sheets; a secondary tray holds 20 sheets of 4- by 6-inch photo paper. Bundled software includes HP PhotoSmart photo editor, and HP Photo Web Site for free Internet posting.

The printer has a 5,000 page-per-month duty cycle and rated speeds of 12 ppm for text and 10 ppm for color prints. Our 8- by 10-inch test photo printed in an acceptable 7 minutes 16 seconds.

The HP PhotoSmart P1100 delivers good value to the broad market of desktop PC and digital camera users.

HP PhotoSmart P1100. Street price: \$500. Requires: 16MB RAM (32MB RAM required for Microsoft Windows NT 4.0); 150MB hard disk space; Mi-

crosoft Windows 95, 98, or NT 4.0 or later. Hewlett-Packard Co., Palo Alto, CA; 800-752-0900; www.photosmart.com.

Kodak Personal Picture Maker PM100 by Lexmark

The Kodak Personal Picture Maker PM100 by Lexmark, co-marketed by Lexmark International and Eastman Kodak Co., is a bargain-priced, sturdy text, color graphics, and photo printer—a good fit for digital camera users who value the convenience of direct printing from a memory card or Zip Drive over printing speed. With no trade-off in quality, the PM100 produces stunning photo prints.

The 13.0- by 16.5- by 18.0-inch (HWD, all trays extended) PM100 attaches to a PC's parallel port and includes an adapter for a parallel port connection to an external 100MB or 250MB compatible Zip Drive. There are slots on the top of the printer for the insertion of SmartMedia or CompactFlash memory cards. Operator controls for PC-based printing include power and paper feed buttons with two indicator lights. The direct printing control panel includes an LCD and six buttons for managing photo prints—menu left and right, select, return, index, and print.

There are many options for manipulating photo prints directly from the printer with no

PC connection, including selecting number of copies, paper size, print quality, cropping, adding frames, captions, and templates, and printing in index and wide-angle views. You can print stored photos directly from the Zip Drive.

The PM100 prints on photo, plain, coated, stickers, transparencies, banner, greeting card, T-shirt transfer paper, or envelopes. There is only one user-controlled print-quality setting on the driver screens—selecting 600 or 1,200 dpi. No bundled software comes with the printer other than a simple calendar program.

A color ink cartridge is included with the PM100, with a replacement cost of \$36 (street). For text printing, a black ink cartridge is available for \$29.50 (street). At the printer's rated yields, per-page ink cartridge costs are \$0.05 for black and \$0.13 for color. The print driver screen provides a clear graphic of the ink cartridge level.

At 1,200 by 1,200 dpi, the PM100 prints brilliant photo glossies. Our test prints displayed bright colors, realistic flesh tones (again with minor red pushing), and good image details, although close examination revealed minor graininess. Printing time for our 8- by 10-inch test photo at the highest-quality setting was 8 minutes 57 seconds, the longest of the three tested printers. The printer's rated speeds are 4 ppm for text and 2.5 ppm for color graphics.

The Kodak Personal Picture Maker PM100 by Lexmark is a practical choice for anyone who wants an all-purpose printer that provides a fast start for printing digital photos via convenient film media slots.

Kodak Personal Picture Maker PM100 by Lexmark. Street price: \$150 after \$50 rebate. Requires: 8MB RAM; 20MB hard disk space; Microsoft Windows 95 or 98. Lexmark International Inc., Lexington, KY; 800-539-6275; www.lexmark.com. **PC**

SUMMARY OF FEATURES

Photo Ink Jet Printers

	Canon BJC-8200 Color Bubble Jet Photo Printer	HP PhotoSmart P1100	Kodak Personal Picture Maker PM100 by Lexmark
Street price	\$400	\$500	\$150 (after \$50 rebate)
Maximum resolution (dpi)	1,200 x 1,200	2,400 x 1,200	1,200 x 1,200
Rated speed	4- by 6-inch photo, under 1 minute; 8- by 10-inch photo, under 3 minutes	Black, 12 ppm, color, 10 ppm	Black, 4 ppm, color, 2.5 ppm
Tested time to print 8- by 10-inch color photo (minutes:seconds)	6:30	7:16	8:57
Ports and slots	Parallel, USB	Parallel, USB, CompactFlash Type I and II, SmartMedia, Infrared	Parallel, CompactFlash Type I, SmartMedia
Bundled software	Adobe PhotoDeluxe 3.0 (PC), Adobe PhotoDeluxe 2.0 (Mac)	HP PhotoSmart, HP Photo Website	None

OmniPage Pro Turns 10

Caere's OCR program gets a new OCR engine, more features, and an enhanced interface.

By Alfred Poor

Caere Corp. continues to build more features and value into its popular OmniPage Pro optical character recognition (OCR) program. Version 10 of this powerful utility is easier to use than ever, yet it still costs only \$100 (street) as an upgrade to any OCR package (most scanners come with an OCR package).

The most visible changes are in the user interface. Choose between AutoOCR and Manual-OCR settings on the program toolbar and the package will scan your documents, identify the different regions of the pages, and convert the letters and numbers to text while preserving the graphics. You can scan in color, and you can either extract just the text or preserve the whole page layout including graphics. The OCR wizard guides you through the different choices.

You can choose to have the output go directly to a file such as a word processing document or a Web page, or the data can be copied to the Windows Clipboard so that you can paste it directly into some other program. OmniPage Pro 10 has a new output choice: voice read-back. A pleasant voice will read the recognized text back to you—especially helpful when you're trying to proofread a table of numbers.

Caere bought two leading OCR software companies—Calera Recognition Systems in 1994 and Recognita in 1996—and this version incorporates their recognition engines. Caere's new Predictive Optical Word Recognition Plus+ technology then weighs the probability for each engine's conclusion for better accuracy.

A new table-editing feature makes cleaning up table contents before exporting easier. Caere also bundles OmniPage

Web Personal Edition, which simplifies the creation of structured Web sites directly from scanned documents.

We tested the program using a variety of targets. The results were not perfect, but they were extremely accurate, and it took a short time to edit them. OmniPage can work with an automatic document feeder on a scanner or multifunction peripheral to scan and recognize a stack of papers unattended. The program is multithreaded; it works at recog-

EASY AS ABC: OmniPage Pro 10 can automate the entire OCR process but gives you lots of control—such as specifying the type of content in scan zones—if you want it.

nizing one page while it is scanning another.

If you find that the speed and accuracy of the utility that came with your scanner leave something to be desired, consider the upgrade to OmniPage Pro 10. The utility is probably faster and more accurate than most users' efforts would be on their own without such a program—



especially when trying to retain the fonts, formatting, and graphics layout of the original page. **OmniPage Pro 10.** Street price: \$500 (\$100 for competitive upgrade). Caere Corp., Los Gatos, CA; 800-535-7226; www.caere.com.

Partition and Conquer

PartitionMagic 5.0 is the tool of choice for modifying your hard disk partitions.

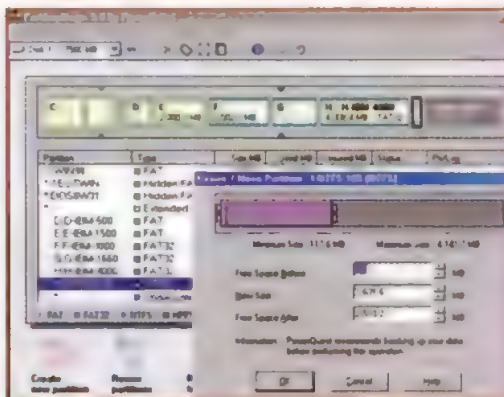
By Edward Mendelson

PowerQuest Corp.'s PartitionMagic has always been the only program that expert users trust to resize or move hard disk partitions or to make other deep changes in their disk structure, and the just-released Version 5.0 (\$70 street) performs even more dazzling technical feats than its predecessors.

Unlike the utilities supplied with Microsoft Windows, PartitionMagic doesn't destroy data when altering the disk structure. The program also goes beyond all other utilities in its ability to merge partitions, convert FAT and FAT32 partitions into NTFS partitions and back again, and manage Linux partitions along with DOS and Windows-based partitions.

The graphic interface has been refined to display more information about your system, and new wizards guide nontechnical users through the intricacies

of redistributing free space among multiple drives or setting up a machine to receive a new operating system. The program now lets you merge the contents of two FAT or FAT32 partitions, merge a FAT with a FAT32 partition, or merge two FAT partitions and convert the resulting partition to FAT32.



PRESTO: Drag on a drive in PartitionMagic to resize or move it. Other operations are only a menu away.

The main interface displays each of your drives as a diagram, with each partition color-coded to show its format. Partitions can be created, resized, moved, deleted, hidden, or converted. Extensive changes can

be made in batch mode.

Other utilities in the package help you set up your system for switching easily among multiple operating systems, each with its own boot partition, and move applications from one drive or partition to another. The utility BootMagic creates a menu that appears when your machine first boots up and lets you choose whether to boot from any one of four partitions. A one-of-a-kind utility called PQBoot lets you switch boot partitions from the

command line without using BootMagic or any other boot manager software.

Only daredevils will use a product this powerful without a full set of backup tapes, but PartitionMagic has demonstrated its reliability over years of hard use. The utility is essential for all advanced users and safe enough for anyone who wants an efficient, well-organized disk.

PartitionMagic 5.0. Street price: \$70. Requires: 16MB RAM, 12MB hard disk space. PowerQuest Corp., Orem, UT; 800-379-2566, 801-437-8900; www.powerquest.com.

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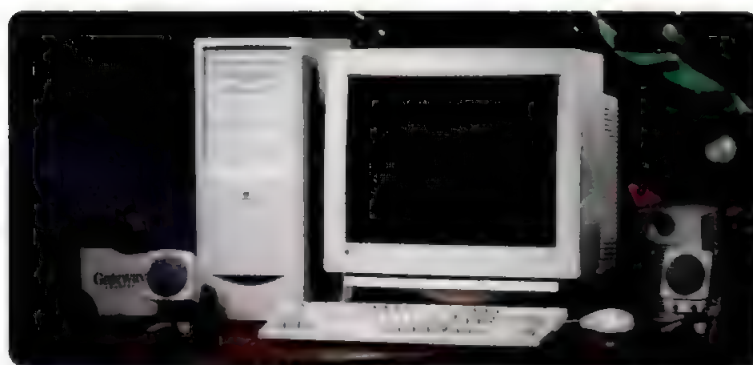
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Psion, Only Smaller

Stay organized and connected in style with the Revo, Psion's new PDA.

By Bruce and Marge Brown

Look under the hood of the Psion Revo's (\$400 street) smart-looking silver and gray case and you'll find it packed with goodies—a sliding cover that converts to a tilted monochrome screen, an internal speaker for alarms, internal nickel hydride batteries, 8MB of RAM, plus PIM and office management applications.

With its ARM 710T RISC processor running at 36 MHz, the Revo's responsiveness is impressive. Although the unit is slightly larger than Palm organizers and Windows CE Palm-size PCs, at 0.8 by 6.0 by 3.0 inches (HWD), the Revo weighs only 7.8 ounces with batteries. Yet it has a comfortable (for its size) 12-mm center-to-center key spacing, 53-key QWERTY keyboard, and a display with a 1.5-by 4.5-inch (HW) viewing area.

Psion's exceptionally good use of shaded menus enhances the 480-by-160 pixel, 16-gray-scale reflective touch screen, which has contrast adjustment but no backlighting.

Plentiful Microsoft Windows-style applications are built into the Revo's 8MB of ROM, and they run seamlessly under Symbian's EPOC32 v.5.0 operating system. Connectivity programs include PC synchronization, Internet e-mail, a Web browser, infrared Phonebook, modem links to compatible cellular phones, and infrared file exchange with other Revos, Psion Series 5mx PDAs, or infrared-enabled printers.

A standard docking station connects to a PC serial port. An AC power adapter for the docking station can also be used independently with the Revo, so you can recharge the battery (rated for 14 hours of normal use) with or without a PC connection. With the Revo connected to a PC via

the docking station and with the included PsiWin v.2.3 application running, you can back up Revo files to your PC, manage them in Microsoft Windows Explorer, print them, and process them on your PC via automatic conversion to Microsoft application file formats. These features worked flawlessly in our testing.

The Revo provides Internet connectivity for POP3 e-mail and Web browsing with a travel modem (\$199 list) or infrared connection to a cellular phone equipped with a modem, such as

several Ericsson and Nokia models. With a modem connection, the Revo's e-mail application supports two-way e-mail and SMS messaging.

We tested e-mail and Internet access both with an Ericsson CF888 GSM digital phone and

FINE PRINT: The Revo crams a comfortable, 53-key keyboard into a pocket-size PDA.

using an EarthLink connection. The 19.2-Kbps GSM modem takes a good while to download typical Web pages to the Revo, but the process does work.

For a change from Palm and Windows CE organizers, plus the advantage of a Symbian OS device designed to work with GSM phones, the Psion Revo is an intriguing choice.

Psion Revo. Street price: \$400. Requires: 16MB RAM; 30MB hard disk space; CD-ROM drive; Microsoft Windows 95, 98, or NT 4.0 or later. Psion Inc., Concord, MA; 800-997-7466; www.pSIONUSA.com.

Wider Wireless Access

ThinAir v1.4 lets Palm VII users access e-mail using their existing mail accounts.

By Bruce Brown

Adding another account just for the ability to receive e-mail wirelessly is often more trouble than it's worth. Enter ThinAirApps.com with a new wireless e-mail application, ThinAir v1.4 (free download), that lets you access your existing POP3, IMAP, and Hotmail accounts to receive and send e-mail using the Palm VII.

You can use ThinAir to access

newsgroup messages and try a beta of an ICQ client, but the main use of the program is to check e-mail. You can configure up to three e-mail accounts on the Palm VII with ThinAir. We tested with an EarthLink e-mail account and with a Yahoo! mail account. For each account you specify your e-mail address, user name, the e-mail service host, the service protocol (choosing from POP3, IMAP, and Hotmail), and you can also opt to save a password and e-mail signature.

When you finish the setup for each account, ThinAir registers the account with the ThinAirApps server and verifies that the account information is accurate. ThinAirApps stores account information on its server in encrypted form and transmits the

data using 128-bit SSL encryption.

ThinAir's first-level display has icons for Setup, Write, Find, and Help. By clicking on an account number on a scroll-down screen, you select which e-mail account to access and then tap Inbox to check your e-mail.

Although there is no charge for the ThinAir application or for accessing e-mail via the service, the usual Palm VII usage charges apply. ThinAir doesn't use the Palm VII address book application in the current version, so you'll need to enter e-mail addresses manually. Looking ahead, the company is about to release a corporate product, ThinAir Secure Server, which will let users access corporate e-mail systems.

If you're attracted to the Palm VII's wireless query capabilities but turned off by needing to use another e-mail address, ThinAirMail may be your killer e-mail app.

ThinAir v1.4. Price: Free download. Requires: Activated Palm VII; POP3, IMAP, or Hotmail e-mail account. ThinAirApps.com; New York; 212-343-5000; www.thinairapps.com.



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** Stanford Resources, Inc. Monitrak U.S. Desktop PC Independent Monitor Shipments Q2 '99 and Display Search, Quarterly Supply vs. Demand Study; Desktop Monitors Q3 '99.

Break out of the Browser

A smarter Internet assistant, OmniViewer lets you choose what parts of the Web you want to see.

By Bill Machrone

Your browser is a window to the world. But it's only one window—and a very big world. Content owners and users alike have come to regard the browser frame limiting. Push technology was an early response to the constraints of the browser frame, but one that was roundly rejected by users. More recently, we've seen a new class of applications, loosely termed *Internet assistants*, which live outside the browser frame, usually in the form of tickers or toolbars. EntryPoint, a comeback move for PointCast, and Winfire are two such products.

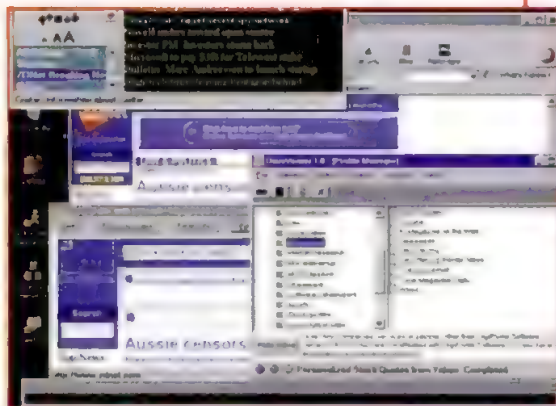
OmniViewer, from DigiPortal Software (www.digiportal.com), is superficially similar to these

Internet assistants, with scrolling headlines from Web sites. But that's where the similarity stops. OmniViewer (\$34.95 direct) has no content partners and no prearranged buttons. You choose the Internet or intranet sites that you want to see headlines from simply by dragging their profiles into one or more viewer windows.

Beyond the usual news, weather, stocks, and sports, you can blend in eBay auctions, job searches, and new shareware listings as they're posted. OmniViewer can even accommodate subscription and password-protected sites such as *The Wall Street Journal*.

As with other assistants, click on items of interest and OmniViewer will take you to the site.

POINTS OF VIEW: Here's OmniViewer's vertical news viewer, profile manager, and horizontal stock ticker at the bottom, plus two browsers—its text-only browser and a standard view—each showing a news story.



The site is displayed in your default browser or, optionally, its own internal all-text browser, which ignores graphics, speeding the display of information. You create or modify OmniViewer profiles with built-in wizards, or you can use existing profiles as templates for new sites.

Although OmniViewer is simple to operate, it's vastly more powerful and configurable than other Internet assistants. If you

get in too deep too fast, you stand the chance of confusing yourself. But learning the product's capabilities will put you in complete control of the torrent of information pouring forth from the Web. **OmniViewer.** Direct price: \$34.95. Requires: 16MB RAM; 4MB hard disk space; Microsoft Windows 95, 98, or NT 4.0. DigiPortal Software LLC, Millwood, NY; 914-923-8277; www.digiportal.com.

Small-Business Wonder

SmartOnline.com provides the tools and expertise to take the trepidation out of launching a new business.

By Greg Alwang

SmartOnline.com (www.smartonline.com) provides Web-hosted business tools aimed at small businesses and entrepreneurs. SmartOnline.com assists with everything from starting, financing, and expanding a small business to corresponding with customers. More than just a resource for small-business owners,

SmartOnline.com conveys the look and feel of a polished CD-based application in an up-to-date online form.

In addition to business and marketing plan wizards, SmartOnline.com helps you create legal forms and letters (in four languages), incorporate a business, conduct market research, and rent property. The marketing research, rental, incorpora-

tion, and legal form applications are localized by state and region.

To help you create business documents, SmartOnline.com provides wizards that ask a series of financial and business-related questions and compile the results in an online document that you can save in RTF or HTML format.

The results were surprisingly complete: Our sample business plan created loads of comprehensive tables ranging from our target market segments to our assets and liabilities. The program then used this information to include a Break Even Analysis table and graph in case you're seeking financial backing. You can even control who has access.

All market research and business letters are free; selected legal forms cost \$5 each. The incorporation and rental application costs \$15 per instance, and the business and marketing plans are \$25 each.

An extensive reference section includes business finders, area and ZIP code lists, language translation, dictionaries, and encyclopedias. For users seeking live professional advice, the Community section lets you pose questions directly to business experts via e-mail.

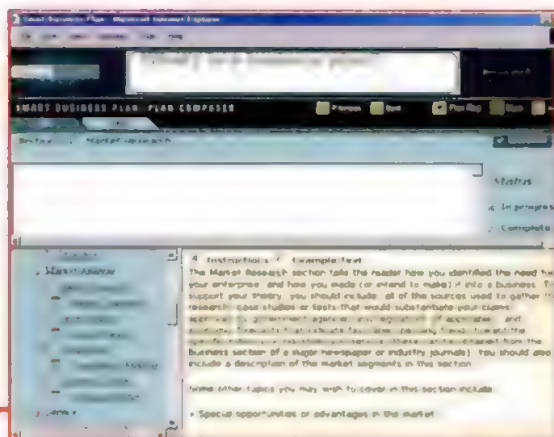
Free registration also includes Office Online, which gives you an e-mail account, online calendar, and contact manager. VIP options let you extend your Office to include unified messaging features and more storage space starting at \$2.50 per month.

SmartOnline.com's unique approach of delivering its business knowledge through easy-to-use Web-based applications will help you accelerate the process of getting your business off the ground.

SmartOnline.com. Price: Registration, free; forms and plans range from \$0 to \$25 each. Smart Online Inc., Research Triangle Park, NC; 800-791-1000; www.smartonline.com.

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Personal Projector

A new lightweight data projector from InFocus is light and bright, but it comes at a heavy price.

By Alfred Poor

The new, under-5-pound class of data projectors promises to revolutionize business presentations. Compaq and Lightware were the first to market (First Looks, September 21, 1999), and now InFocus has weighed in with its 4.8-pound marvel, the InFocus LP330, dubbed the "Dragonfly." But it comes with a full-freight price of \$5,900 (street), nearly a third more than Compaq's competing unit.

For this price, however, you get a fully equipped system with no extras required. The LP330 has both manual focus and zoom and comes with a remote control with a reduced, yet sufficient, set of buttons that work easily with the on-screen configuration menus. The remote doubles as a wireless



POUND-PER-POUND: The InFocus LP330 packs a lot of performance and features into a 4.8-pound package.

mouse when the projector is connected to a computer. The projector has a single monaural speaker (it accepts stereo inputs) that fills a typical conference room without distortion.

The projector was able to synchronize fairly well with the ana-

log input signal, though some additional tweaking was required for image position and clock timing. Once adjusted, the image was

rock-steady, with no signs of pixel jitter.

The image was well focused, with only a slight trace of fuzziness in the corners. Brightness and contrast controls were effective, though the image was a bit weak at the dark ends of the gray scale.

Our tests showed the image to be brighter than that of the Compaq unit, at 695 lumens. As might be expected with a projector using the Texas Instruments DLP

micromirror chip, the contrast was good at 162:1, though some light leakage raised the brightness uniformity ratio to 1.61, which is good but not excellent.

Image quality was excellent for both data and video, as was color tracking. There were no pixel flaws (which are common on LCD-based projectors), and colors were strong and clear. The only drawbacks were that there was a fair amount of light that leaked out the back of the projector and the noticeable sound of the cooling fan and color wheel.

InFocus includes a two-year warranty, with one-year rapid-exchange coverage. The 120-watt lamp is rated for 1,000 hours of use. The projector also comes with a soft carrying case and a wide assortment of cables and adapters. The whole kit makes a welcome, lightweight addition to any road warrior's outfit.

InFocus LP330. Street price: \$5,900. InFocus, Wilsonville, OR; 800-294-6400; www.infocus.com.

Whiteboard Wonder

The Virtual Ink mimio captures whiteboard content for easy distribution.

By Bruce and Marge Brown

By integrating ultrasonic, infrared, and PC technologies, the Virtual Ink mimio (\$500 street) turns ordinary whiteboards and dry markers into electronic capture devices. Whiteboard text and drawings are converted to electronic files and stored in a connected computer, allowing instant editing, color printing, history retrieval, and distribution.

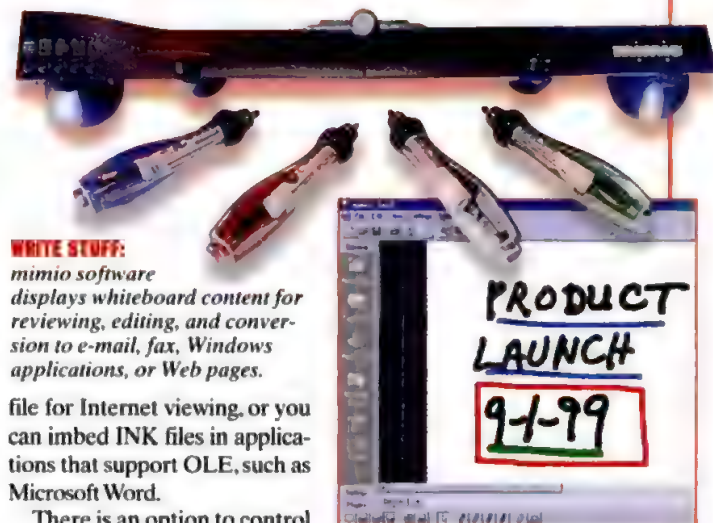
The mimio requires about 10 minutes to set up and is intended for use on any solid, smooth surface (it won't work with flimsy paper flip-charts). A folding capture bar attaches with suction cups to the left side of any whiteboard between the sizes of 2 by 3 feet and 4 by 8 feet. The capture bar, with five function switches, contains a microcontroller, infrared detectors, and a serial in-

terface for connection to a PC with an included 10-foot cable.

Four battery-powered marker jackets and an eraser have built-in ultrasound and infrared transmitters. Two triple-A alkaline batteries, four Expo dry-erase markers, and mimio software are included.

Our test with a conventional whiteboard produced good results, but the capture bar did not hold on a wall or on mounted static presentation paper.

As you record strokes on the whiteboard, they appear on virtual whiteboards in the mimio application as INK files. From the PC you can convert mimio session files to JPEG or BMP images and send e-mail directly from mimio through MAPI-compliant systems. The mimio has a convenient feature to convert your session to an HTML



WRITE STUFF: mimio software displays whiteboard content for reviewing, editing, and conversion to e-mail, fax, Windows applications, or Web pages.

file for Internet viewing, or you can imbed INK files in applications that support OLE, such as Microsoft Word.

There is an option to control the application screen from the whiteboard with the included mimioMouse program and pen insert. mimio extras include establishing mimio-to-mimio virtual whiteboard communication through Microsoft Net-Meeting and playing back presentations with full-motion pen strokes.

An innovative take on white-

boards, the Virtual Ink mimio is a good choice for documenting brainstorming sessions anytime, anyplace.

Virtual Ink mimio. Street price: \$500. Requires: 16MB RAM; 10MB hard disk space; CD-ROM drive; Microsoft Windows 95, 98, or NT 4.0 or later. Virtual Ink Corp., Boston; 877-696-4646; www.virtual-ink.com.

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CD-RW Hits the Road

Portable CD-RW drives all perform about the same, but there are important differences.

By Daniel Grotta and Sally Wiener Grotta

Almost every notebook PC comes equipped with a CD-ROM drive, but few with a CD-R and almost none with a CD-RW drive. That's about to change as portable CD-RW drives hit the market. Designed specifically for laptops, the five drives we tested are built on the same components and deliver similar performance. But the devil is in the details; seemingly minor features such as battery options and bundled software are what separate the good peripherals from the great ones.

All five drives reviewed here have much in common: They are based on the Matsushita raw CD-RW ATAPI 4X Write 4X Rewrite 20X Read drive with 2MB buffer and connect to notebook PCs via PC Card slots (though the Micro Solutions backpack bantam cd-rewriter also has a parallel interface). Three of the drives offer a SCSI-2 interface; the other two rely on Enhanced IDE. Finally, each drive comes with an AC adapter, audio port, and Adaptec's Easy CD Creator Version 3.5c and DirectCD, which makes writing to a CD-R disk like saving files to your hard disk.

Not surprisingly, the write times were virtually identical for each drive—about 20MB per minute. For testing, we used Easy CD-Creator. The drives all came through with flying colors: no reported data errors, no buffer overruns, and no dud CDs. We also recorded audio on CD-Rs, again without a hitch.

This is not to say that portable CD-RWs are mere commodities and should be chosen by price alone. For example, if you want to use it on the road, the Smart and Friendly CD Pocket RW and

the CT&R Compro SlimLine 4420 provide battery power. Alternatively, the parallel interface on the HP CD-Writer Plus M820e and the USB interface on the Compro SlimLine give you the flexibility to use them at home with a desktop PC.

Although the competition was close, our top choice is the Smart and Friendly CD Pocket RW. It's the only drive that comes with an integrated, rechargeable battery and extra software. Besides, it looks great. The only thing missing is a USB interface. The Compro SlimLine was a close second with its USB interface, but its external battery pack made the drive a little larger, heavier, and more unwieldy than the CD Pocket RW.

CT&R Compro SlimLine 4420

The CT&R Compro SlimLine 4420 (\$320 street), from CT&R (formerly ACS In-

novations), is the only model that offers both USB and PC Card connectivity. It's also the only front loader with power switches located conveniently on both the unit and the separate battery compartment. The Compro SlimLine's housing has dimples on the top for a good grip, and a groove on the left side for attaching the battery compartment.

Setup and installation were trouble-free. CT&R provides a 15-page user reference guide and a 53-page manual on Easy CD Creator and DirectCD. As with the other drives, performance was flawless.

One drawback to the Compro SlimLine is its size and weight. At 17.6 ounces and 6.6 by 5.9 by 0.8 inches, the Compro is the second heaviest and the second largest drive of the group. Adding a loaded battery compartment further increases the weight (to 23 ounces) and width (to slightly over 7 inches) of the unit. CT&R does not provide rechargeable double-A batteries, which will add \$15 to \$39 to the cost, depending on the type you choose (nickel cadmium or nickel hydride). Finally, the Compro SlimLine has the largest AC adapter and the shortest cable (17 inches).

If you like to travel light, the Smart and Friendly CD Pocket RW

HP CD-Writer Plus M820e Panasonic KXL-RW10A

Like identical twins, the HP CD-Writer Plus M820e and Panasonic KXL-RW10A are hard to tell apart because they have the same dimensions (5.1 by 6.4 by 0.9 inches), weigh virtually the same (the HP CD-Writer is just a hair lighter at 12.7 ounces—making it the lightest unit we tested), and include the same software. Both have on/off switches on the front, a volume control (the HP CD-Writer comes with a pair of tiny earphones), and an LCD control panel that displays little useful information.

The HP and the Panasonic units each have a SCSI-2 card. You choose either 32-bit (Card-Bus) or 16-bit, depending on the capabilities of your notebook PC. The 19-inch cable can be detached from the PC Card, letting you quickly stow the

drive away without having to remove the PC Card every time. Underneath the drives are tiny DIP switches for setting SCSI ID. Being SCSI, both drives can be attached to a PC with a SCSI card, via an optional cable.

Of the drives reviewed here, these two were the easiest to set up and install. Hewlett-Packard provides an illustrated setup poster, and the Panasonic unit comes with a 28-page setup manual and 44 pages of operating instructions. Both provide separate documentation for Easy CD-Creator and DirectCD.



is a better choice. If you don't mind carrying a little extra weight, however, the CT&R Compro SlimLine 4420 is a great choice because the USB interface makes it easy to use the drive with your desktop PC as well.

CT&R Compro SlimLine 4420. Street price: \$320. CT&R Inc., Santa Clara, CA; 408-566-0900; www.acscompro.com.

There are only minor cosmetic differences between the two products. The HP CD-Writer has a matte black finish; the Panasonic unit is metallic silver. The HP CD-Writer's lid is a solid piece of plastic, and the Panasonic's has a small triangular window so you can see whether the disk is spinning. Neither Hewlett-Packard nor Panasonic offers an optional battery compartment.

The HP CD-Writer and the Panasonic unit have many great features, including simple setup, sensible design, and the lightest weight in their class. If you can forgo the

iest drive in our roundup, weighing 21.4 ounces and measuring 6.0 by 8.6 by 0.9 inches. The main reason for the extra bulk is for accommodating the two interfaces and a 2.5-inch internal speaker that delivers tinny mono sound. Though the speaker lacks tone controls, it does have two audio ports, one for an earphone and the other for an additional speaker.

One feature we did like was the cd-rewriter's lengthy cables including a

makes some sense. But unless you really want the parallel cable option, you'll find better solutions.

Micro Solutions backpack bantam cd-rewriter. Street price: \$430. Micro Solutions Inc., DeKalb, IL; 800-890-7227; www.microsolutions.com.

side without having the cable running over the top of the drive.

We had to try a couple of times before we got the hang of installation. Oddly, you have to insert the PC Card with the printing on it facing down. Because the CD Pocket RW comes with a CD only (no floppy disk) your notebook PC must have a CD-ROM drive to



battery option, one of these would be a good choice.

HP CD-Writer Plus M820e. Street price: \$400. Hewlett-Packard Co., Loveland, CO; 800-826-4111; www.hp.com/go/cdr.

Panasonic KXL-RW10A. List price: \$299. Panasonic Document Imaging Company, Secaucus, NJ; 800-742-8086; www.panasonic.com/office.

Micro Solutions backpack bantam cd-rewriter

Micro Solutions pioneered parallel drives, but its backpack bantam cd-rewriter (\$430 street) branches out, covering both parallel and PC Card interfaces. This lets it attach easily to a PC as well as to a laptop, adding to the drive's versatility.

Unfortunately, the cd-rewriter is the largest and heav-

iest drive in our roundup, weighing 21.4 ounces and measuring 6.0 by 8.6 by 0.9 inches. The main reason for the extra bulk is for accommodating the two interfaces and a 2.5-inch internal speaker that delivers tinny mono sound. Though the speaker lacks tone controls, it does have two audio ports, one for an earphone and the other for an additional speaker.

Setup wasn't always smooth sailing. Although Microsoft Windows 98 immediately recognized the device, we ran into problems installing the driver. Regardless of whether we installed it as a parallel or a PC Card device, we kept getting an error message. The sparse documentation—one double-sided, 11- by 17-inch sheet—provided little assistance, and the software documentation is kept on a disk. Only through repeated installation attempts were we able to get the backup cd-rewriter up and running.

If you think of the Micro Solutions backpack bantam cd-rewriter as a transportable rather than a portable, its design

Smart and Friendly CD Pocket RW

The Smart and Friendly CD Pocket RW (\$400 street) is without a doubt the best-looking CD-RW drive—and it is also the best portable solution. Taking its cue from the Apple iMac, this portable drive has a two-tone design with a clear base and a semitransparent, blue cover.

The CD Pocket RW weighs 15.9 ounces without the battery, and 20.1 ounces with its nickel hydride rechargeable battery pack—the only one of its kind in the group. The unit has no on/off button, though there's a switch for selecting the power source (AC adapter, battery, or direct from the PC Card interface).

The CD Pocket RW is the only drive with its interface connector on the side rather than on the back. If your notebook has card slots on the left, this is especially convenient. The cable isn't long enough, however, to snake around the back of your laptop to position it easily on the right

complete the installation. Smart and Friendly includes a four-page quick-start guide, but all software documentation is on CD. Another quirk: The CD Pocket RW has a SCSI interface, but it has no ID DIP switches. This model isn't designed to work on a desktop PC with a SCSI card. By the time you read this, Smart and Friendly says it will release USB and FireWire connection kits (pricing hasn't been set yet).

The CD Pocket RW comes with a truckload of software including PowerQuest's Drive Image, Sonic Foundry's CD Architect, Diamond Cut Audio Restoration Tools 32, and ECI Disc Inspector Pro. A word of warning: This version of Drive Image isn't for novices. To install it, you must manually copy files to the hard disk and edit the Config.sys file.

The Smart and Friendly CD Pocket RW may have its quirks, but once you get past the installation, it offers the best combination of design and features. **Smart and Friendly CD Pocket RW.** Street price: \$400. Smart and Friendly Inc., Chatsworth, CA; 800-959-7001; www.smartandfriendly.com.

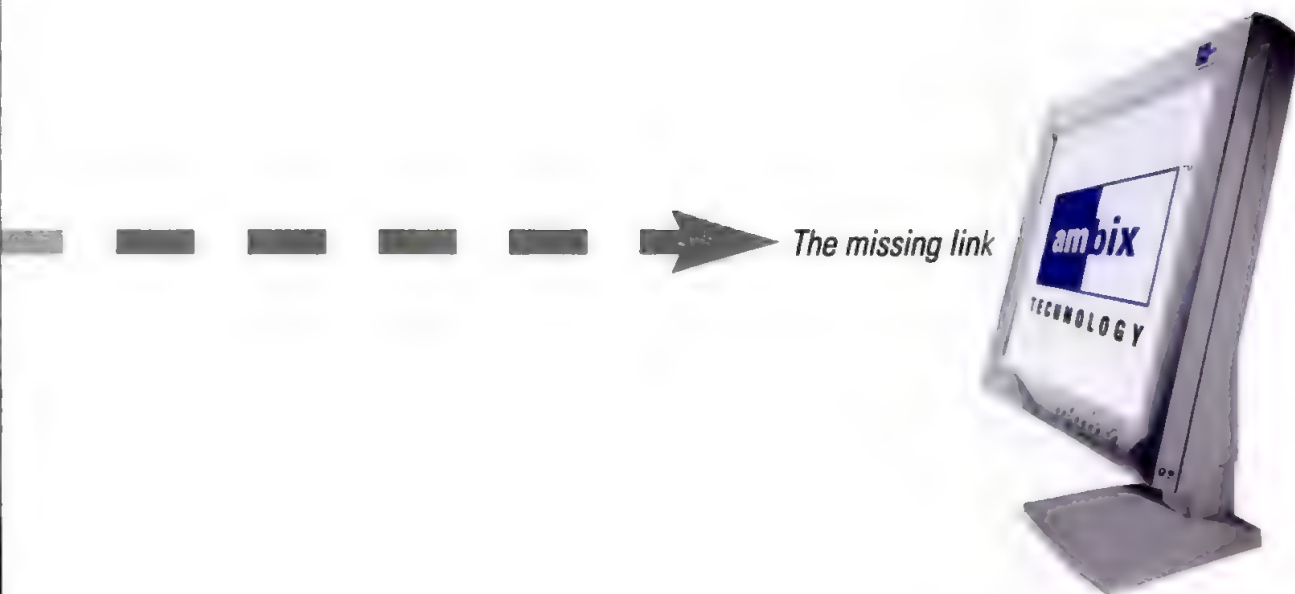
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* The DVI standard is compatible with TMDS based digital technologies like DFP and P&D. NEC provides out of the box DFP compatibility by including a DVI to DFP adapter. P&D adapter sold separately.
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Make Your New PC Like Old

AlohaBob's PC-Relocator and Desktop DNA transfer your PC persona to a new computer.

By Alfred Poor

Sooner or later, all computer users face the same quandary: You purchase the latest computer with its speedy processor and updated operating system, but how do you move all your existing applications and their settings from your old system onto this new machine?

Two new products, AlohaBob's PC-Relocator, from Eisenworld, and Desktop DNA, from Miramar Systems, aim to do away with this dilemma. Each is a one-shot deal (a single transfer per license). You can buy a single license for AlohaBob's PC-Relocator for \$69.99 (direct). With Desktop DNA, however, you must purchase a minimum of five licenses (\$245 direct); additional licenses cost \$49 each, with prices dropping for higher quantities.

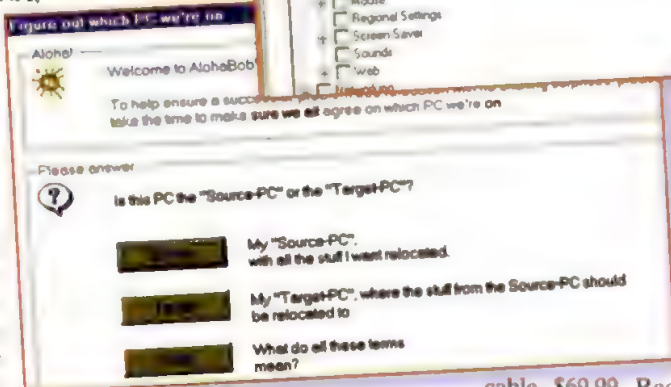
We tested on a desktop PC running Microsoft Windows 95 that has been in daily use for at least four years, with a hard disk partitioned into four drives. Our target system was a new PC with a larger hard disk partitioned into four drives and a fresh installation of Windows 98. What we discovered is that both PC-Relocator and Desktop DNA perform the same basic tasks, but each takes a different approach.

AlohaBob's PC-Relocator

AlohaBob's PC-Relocator is a no-nonsense utility that does its job without requiring much as-

sistance. The software simply moves everything—including all disk partitions—from one system to another, making changes to the Registry and other configuration files as required. You aren't given any choices; just put the floppy disks (both are the same) in the two machines, run the program on each one, and select the Source and the Target. Then sit back

CONTROL FREAK: Desktop DNA lets you select the programs and data to transfer to a new PC. But you must choose carefully, or you could wind up creating problems on your new system.



UTILITARIAN: Just tell PC-Relocator where you want to move everything by specifying the Source and the Target, and the program takes care of the rest.

and sip a tropical drink while PC-Relocator does its job.

Our version came with a parallel cable, but this should be your method of last resort. We used a 100Base-T network, and our test transfer took 1 hour, so it could take overnight or longer to complete the same task via a parallel cable. If you have a LAN, opt for the download version (\$49.95), and you'll also save some money. If you do use a network connection, it must use TCP/IP, and you have to provide the target machine with the IP address of the source system.

PC-Relocator successfully moved all our programs, data files, and settings to the new system. It caught everything from custom desktop wallpaper settings to some more obscure Windows and DOS applications. There is no way to include or exclude files; any junk you have on your old system will be faithfully transferred to the new one. But the procedure is seamless and simple—and it works. **AlohaBob's PC-Relocator.** Direct price: Download, \$49.99; with manual and parallel transfer

with a long list of options.

Desktop DNA includes about 30 scripts that cover most popular applications. But there are some notable omissions such as Intuit's Quicken personal finance program, not to mention older applications. Furthermore, the scripts that are included don't always cover all the versions or support all features of the programs.

Problems arise because Desktop DNA will let you attempt to transfer applications and data—including Windows folders—for which it doesn't have scripts. In our first transfer attempt, we chose to move all the contents of all four drive partitions and ended up with a Windows 98 installation that would not run on the new machine. When we stuck to the script (literally), Desktop DNA worked properly.

Desktop DNA also requires a TCP/IP network connection for the transfer, though unlike PC-Relocator, the program is able to identify the source system. The software can be run either directly from the CD-ROM, or you can install Desktop DNA on the source and target systems. We recommend installing it, because this step saves you from having to swap the CD back and forth between systems.

Desktop DNA's ability to let you pick and choose applications and data could be useful in corporations where you have to update many systems, as long as you're certain the program supports your applications.

Desktop DNA. Direct price: For a five-user license, \$245; each additional license, \$49. Requires: Microsoft Windows 95, 98, or NT. Miramar Systems Inc., Santa Barbara, CA; 800-862-2526; www.desktopdna.com.

cable, \$69.99. Requires: Microsoft Windows 95 or 98. Eisenworld, Miami Lakes, FL; 888-392-5642; www.alohabob.com.

Desktop DNA

Desktop DNA attempts to give you more control over the process of moving your data, but in doing so we found it can create some problems. The program relies on predefined scripts to move specific applications and lets you choose which of those you want to move. An attractive wizard provides you

There are many paths to reach independent thought.

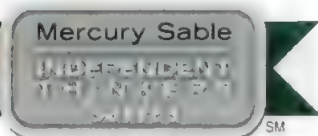
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Bigger, Better Hard Disks

New hard disks from IBM and Maxtor offers lots of space and take advantage of advanced technology.

By M. David Stone

If you're looking for a boost in overall performance, consider a new hard disk. More precisely, consider the IBM Deskstar 34GXP (34.2GB) or the Maxtor DiamondMax Plus 6800 27.3GB. This new generation of IDE hard disks offers high performance—at the eye-opening price of a penny per megabyte.

Both disks come in a choice of capacities, depending on how

We tested the highest capacity variations—the 34.2GB IBM Deskstar 34GXP (\$330 street) and the 27.3GB Maxtor disk (\$280 street). As a baseline for comparison, we also tested the IBM Deskstar 14GXP. As expected, both the new IBM and the Maxtor disks leave the 14GXP far behind.

The IBM and Maxtor disk specifications differ in detail, but they share a number of high-performance features. Chief

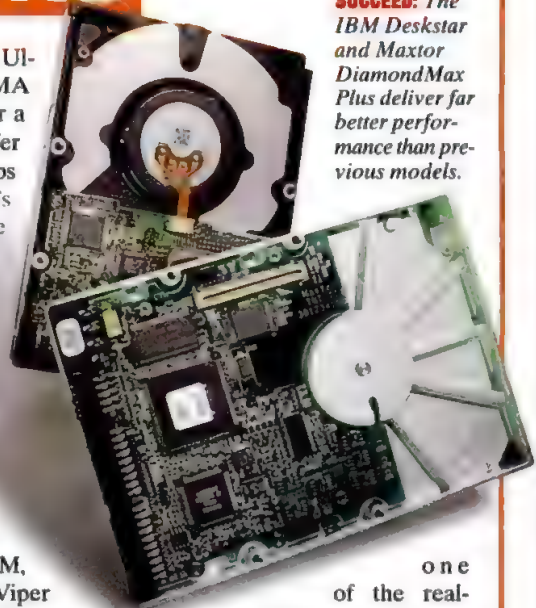
terface using an UltraDMA (UDMA 66) protocol (for a maximum transfer rate of 66.7 MBps between the disk's buffer and the computer).

We tested the disks under Microsoft Windows 98 SE in a 600-MHz Pentium III with an Intel SE440BX-2 motherboard, 128MB of SDRAM, and a Diamond Viper 770 graphics card. We ran one set of tests in UDMA 33 mode, which is what you'll find in most systems, including our test-bed. Then we added Promise Technology's Ultra66 card to our test-bed for the UDMA 66 tests.

Our tests included ZD Business Winstone 99, ZD Business Disk WinMark 99, and loading and saving a 65MB PSD file in Adobe Photoshop 5.0. We tested the drives in UDMA 33 mode first, then installed the Promise Ultra66 card. Results were mixed.

Both disks performed significantly better than the 14GXP reference disk. Despite similar specifications, however, the Maxtor disk did far better than the IBM in UDMA 33 mode in three of the four tests—thanks to a caching scheme that, according to the company, lets the disk take best advantage of its capabilities. On the other hand, the IBM disk fared better than the Maxtor on

DRIVE TO SUCCEED: The IBM Deskstar and Maxtor DiamondMax Plus deliver far better performance than previous models.



one of the real-world sequential transfer tests—saving the Photoshop file to disk.

The differences between the two disks were relatively minor in UDMA 66 mode, with the Maxtor disk turning in slightly better numbers than the IBM disk on three of the four tests. The IBM disk improved its edge over the Maxtor for saving the Photoshop file to disk.

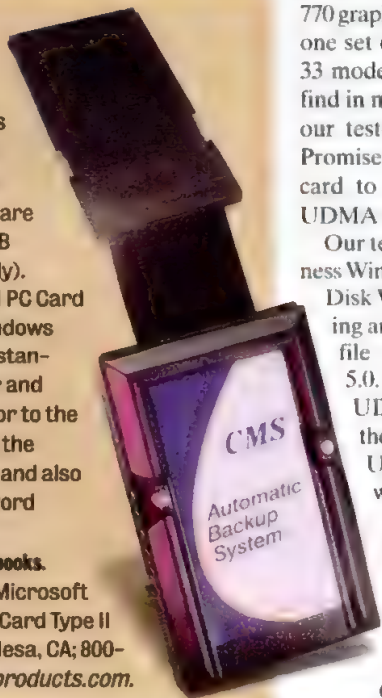
We were surprised that the Maxtor disk didn't do any better with the UDMA 66 connection after its strong showing at UDMA 33. Either disk over either type of connection, however, will be much faster than any IDE drive you've used up to this point.

IBM Deskstar 34GXP (34.2GB). Street price: \$330. Requires: IDE connection, half-height disk bay. IBM Storage Systems Division, San Jose, CA; 888-426-5214; www.ibm.com/harddrive. **Maxtor DiamondMax Plus 6800 27.3GB.** Street price: \$280. Requires: IDE connection, half-height disk bay. Maxtor Corp., Milpitas, CA; 800-262-9867; 408-432-1700; www.maxtor.com.

Basic Backup

The CMS Automatic Backup System (ABS) for Notebooks is a near-perfect solution for mobile users. We tested the 4.3GB version (\$389 list); other model capacities are 6.4GB (\$489), 8.1GB (\$629), and 10GB (\$689, available for Windows NT only). All you have to do is slide the Type II PC Card interface into an available slot. Windows recognizes the disk interface as a standard IDE/ESDI hard disk controller and loads the appropriate drivers. Prior to the initial disk backup, you can specify the source and backup data locations and also select data verification and password protection. —Bruce Brown

CMS Automatic Backup System for Notebooks. List price: \$389 (4.3GB). Requires: Microsoft Windows 95, 98, or NT; available PC Card Type II slot. CMS Peripherals Inc., Costa Mesa, CA; 800-327-5773, 714-424-5520; www.cmsproducts.com.



many platters are in the disk. For the IBM disk, the choices range from 13.6GB to 34.2GB, with two to five platters. For the Maxtor disk, the choices range from 6.8GB to 27.3GB, with one to four platters.

among these are a 7,200-rpm spin rate and a high linear density, which measures how much data fits into any given length of track. Each disk also had a 9ms average seek time, a 2MB buffer, and an Ultra ATA/66 in-

PERFORMANCE TESTS

▲ High scores are best.
▼ Low scores are best.

Bold type denotes first place.

	ZD Business Winstone 99 ▲		ZD Business Disk WinMark 99 (thousands of bytes/sec) ▲		Adobe Photoshop 5.0 Load 65MB PSD (seconds) ▼		Save 65MB PSD (seconds) ▼	
	UDMA 33 mode	UDMA 66 mode	UDMA 33 mode	UDMA 66 mode	UDMA 33 mode	UDMA 66 mode	UDMA 33 mode	UDMA 66 mode
IBM Deskstar 34GXP (34.2GB)	25.8	26.6	3,375	4,413	46.4	37.7	120.0	109.2
Maxtor DiamondMax Plus 6800 27.3GB	27.0	27.0	4,885	4,910	35.0	34.9	138.3	141.5
IBM Deskstar 14GXP (reference)	25.4	25.7	2,557	3,043	55.4	46.8	159.2	159.0

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Brushed-Up Painter

MetaCreations' Painter gets a streamlined interface and support for industry-standard layers.

By Sally Wiener Grotta and Daniel Grotta

Known as the Web edition, Painter 5.5 introduced image slicing and low-bandwidth Web brushes. These and other Web design tools are still present, but in Painter 6 (\$399 list, upgrade \$149) the focus is more on Painter's traditional tools. The program's interface has been streamlined, and the underlying technology behind its signature natural media brushes has been revamped. The result is a faster, more accessible program with more creative tools.

The new brush technology gives you greater speed, accuracy, and responsiveness. Brush strokes are now rendered on the fly. MetaCreations still supplies the old Painter 5 brush library for those artists who have their favorites, but the majority of the brushes in Painter 6 use the new technology. You no longer have to click on a Build button every time you change a brush's parameter. The cursor now displays the current size of the brush on the canvas.

Painter 6 fully supports Wacom Intuos graphics tablets, with their reaction to tilt, bearing, and velocity of your strokes. You can even emulate tilt, velocity, and direction using a mouse. Not all changes are beneath the surface. New Impasto tools paint with the depth and dimensionality of real paint. A Palette Knife can cut through the paint, and the Impasto Light Control gives superb control over detail.

One longstanding problem with previous versions of Painter had been keeping track of the numerous palettes. In

Painter 6, most palettes are nested into three master palettes—Brush Controls, Art Materials, and Objects. The current settings are displayed conveniently in the collapsed title bars.

Painter's confusing floaters have been replaced by industry-standard layers. In fact, Painter 6 maintains layer and mask information in Photoshop's PSD file format. Each layer's mask is editable using any brush, but the masks are kept in a separate palette, which is inconvenient.

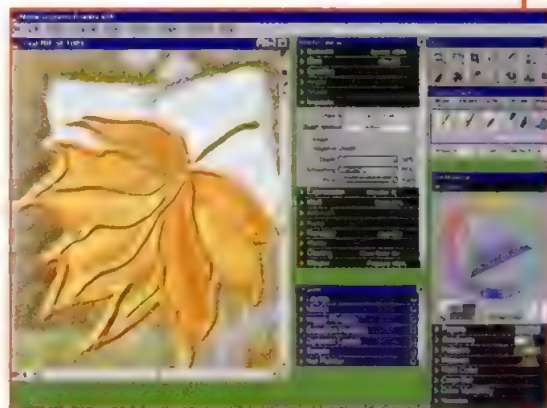
Painter 6 still has its quirks. The selection tools are not as robust as you'd find in image-edit-

REALISM:

Painter has long been known for its natural media tools. New Impasto brushes give paint the depth and dimensionality of the real thing.

ing programs. And there's still no support for right-mouse button menus.

Painter 6 is an important upgrade of a definitive program. Its natural media brushes and canvas effects have been emulated by other programs, but thus far they have never been surpassed.



Painter 6. List price: \$399; upgrade, \$149. Requires: 32MB RAM; 222MB hard disk space; Microsoft Windows 95, 98, or NT 4.0, or Power Macintosh System 8 or later. MetaCreations Corp., Carpinteria, CA; 800-846-0111, www.metacreations.com.

Apple's New OS

Mac OS 9 feels more like a collection of new Internet utilities than an OS upgrade.

By Troy Dreier

You've heard about the iBook and Mac OS X (OS X Server is available. OS X for consumers will come sometime in 2000), but did you know that Mac OS 9 (\$99 direct) was made available recently? Sadly, there's little to get excited about in this collection of interesting but nonessential improvements.

The focal point of OS 9 is Sherlock 2, the latest version of Apple's built-in metasearch tool. Sherlock 2 is successful at doing what Sherlock should

have done all along. Instead of lumping all the various search sites together, Sherlock 2 breaks them into useful, customizable categories, such as Internet, Shopping, and People. But Sherlock 2 is slow and often calls up irrelevant information.

OS 9 seems more useful for the classroom or any shared-use setting. Multiple users can easily share a machine after customizing the Multiple User control panel. When logging on, each person will see his or her own customized desktop with corresponding files and settings. Users

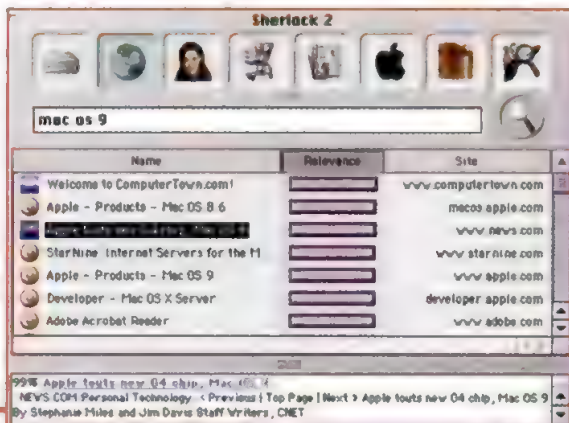
can even log on with voiceprint passwords, which are nifty but didn't al-

ways work smoothly in our testing. The built-in file encryption is easy and effective, as is file sharing over the Internet.

Apple never leaves out designers. OS 9 features ColorSync 3, which comes with an improved control panel and better AppleScript support. A new technology, FontSync, promises the same control over type.

OS 9 offers speech recognition for basic commands. In our testing, the product worked well if commands were spoken slowly and clearly. A Keychain control panel promises to remember all your passwords. This sounds useful, but this first version is poorly executed, being dependent on third-party developers to add Keychain technology to their applications.

Playing with the tools in Mac OS 9 is fun, and if you're still running OS 7, you'll appreciate it. But if you already have OS 8.x and you're on a budget, you can easily wait for OS X next year. **Mac OS 9.** Direct price: \$99. (Rebate available if upgrading from 8.5, 8.5.1, or 8.6). Requires: Apple Macintosh PowerPC, 32MB RAM. Apple Computer Inc., Cupertino, CA; 408-996-1010; www.apple.com.

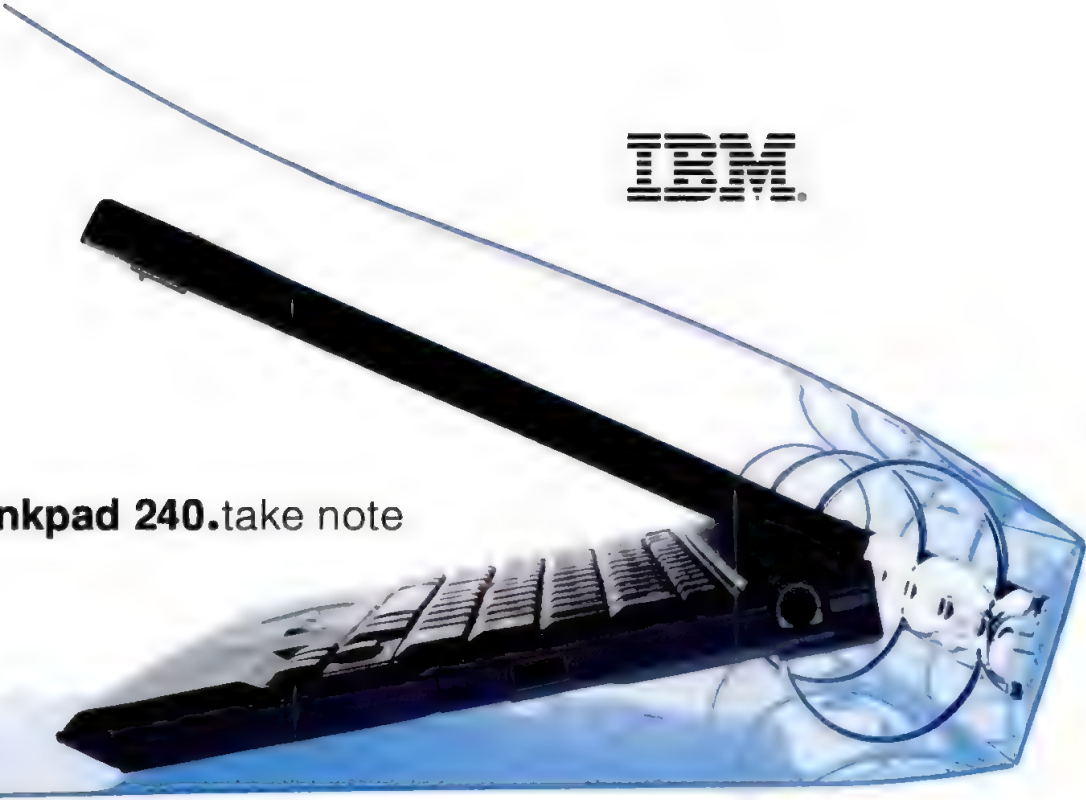


SIMPLE SEARCHING:

The upgraded Sherlock metasearch utility lets you refine searches based on categories such as shopping.



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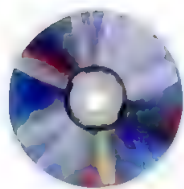
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PNA 2.0 Hits Home

The second time around, this phone-line networking protocol looks like a winner.

By Les Freed and Steve Rigney
The home networking market has suddenly started to heat up, driven by the demand for Internet access for the entire family and the rising number of households with more than one PC. A new specification, Home PNA 2.0, is producing faster, less expensive home networking solutions.

Home PNA 2.0 offers several advantages over older technologies. Like the first-generation PNA, it uses your existing phone lines, but it can operate at speeds up to 10 Mbps. Unlike Ethernet, Home PNA doesn't require a hub; each PC simply connects to the nearest telephone jack. (It doesn't interfere with the phone's normal operation.) Furthermore, Home PNA 2.0-based products are easy to install, work well, and cost less than \$80 per PC. Finally, they are all interoperable and backward-compatible with the older 1-Mbps solutions.

The Home Phoneline Networking Alliance reads like a Who's Who of networking, and members such as Intel and 3Com should be offering solutions by the time you read this. For this story, we tested the first two Home PNA 2.0 solutions available, the D-Link DHN-910 10Mb Phoneline Network in a Box (\$120 street) and the NetGear Phoneline10X PCI Adapter Card (\$80 street). Both are 32-bit PCI NICs that operate much the way conventional Ethernet adapters do.

Although the NetGear Phoneline10X is less expensive, it includes only one PCI card (you'll need two), while the D-Link DHN-910 includes two. Both the D-Link and NetGear adapters have two RJ-11 ports

on each card. Typically, you will need only one of these ports unless you want to connect two PCs directly that are located in the same room.

Both solutions are easy to install and configure, and both bundle all the software you need. You can use them with any Internet access-sharing software, but

adapters, network drivers, Internet connection-sharing software, and two 15-foot standard, voice-grade telephone cables. The kit also contains a couple of shareware multiplayer games.

The network adapters plug into any standard PCI slot and come with drivers for Microsoft Windows 95 OSR2 and later and Windows NT. You must install the D-Link DHN-910 drivers and Internet access-sharing software separately. Nevertheless, we found the kit fairly easy to install,

the other PC to its IP address, using the proxy settings menu. **D-Link DHN-910 10Mb Phoneline Network in a Box.** Street price: \$120. D-Link Systems Inc., Irvine, CA; 800-326-1688; www.dlink.com.

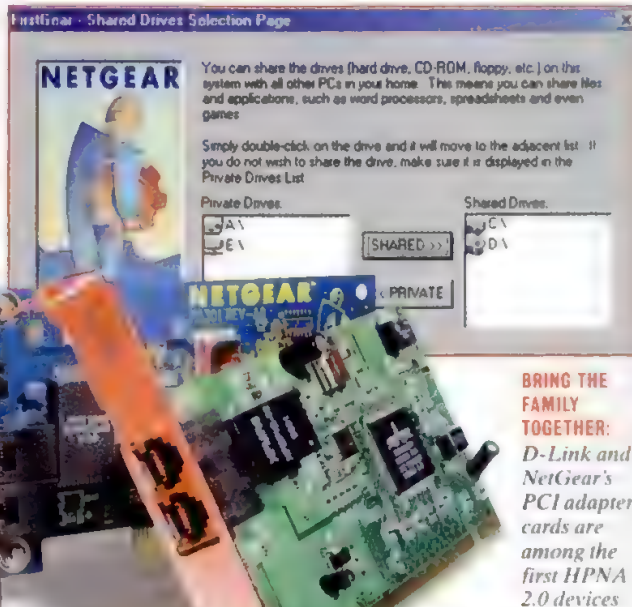
NetGear Phoneline10X PCI Adapter Card

In addition to the single PCI card, the NetGear Phoneline10X PCI Adapter Card (\$80 street) includes NetGear's FirstGear networking add-on, a 10-foot phone cable, and a copy of Ragula Systems' FatPipe Internet-sharing software. You're on your own for multiplayer games.

Installation is simple. A fold-out installation guide contains detailed phone wiring diagrams and hardware installation instructions. When you plug in the card, the system automatically installs the necessary drivers. NetGear provides drivers for Windows 95 and 98 but not Windows NT. Unlike D-Link, NetGear also provides a single setup program for both the companion FirstGear software and FatPipe utility. The entire process takes only a few minutes. If you encounter problems, NetGear includes round-the-clock toll-free support.

Once you've completed the initial installation, you can use FirstGear's wizard to set up sharing of drives, printers, and even Internet access via integration with FatPipe. To access these shared resources from another PC on the network, you use the standard Windows tools.

Rather than a proxy server, FatPipe uses network address translation (NAT) services, but the end result is the same: It lets several users share a single Internet connection. FatPipe includes a DHCP server, so users don't have to set individual IP addresses for each PC on the network. **NetGear Phoneline10X PCI Adapter Card.** Street price: \$80. NetGear Inc., Santa Clara, CA; 888-638-4327; www.netgearinc.com.



BRING THE FAMILY TOGETHER: D-Link and NetGear's PCI adapter cards are among the first HPNA 2.0 devices

each includes a utility for this purpose. We tested with a variety of connection types (dial-up, cable, and ISDN), and both solutions worked as advertised. The D-Link DHN-910 has a slight edge, however, because it supports Microsoft Windows NT and has a few extras.

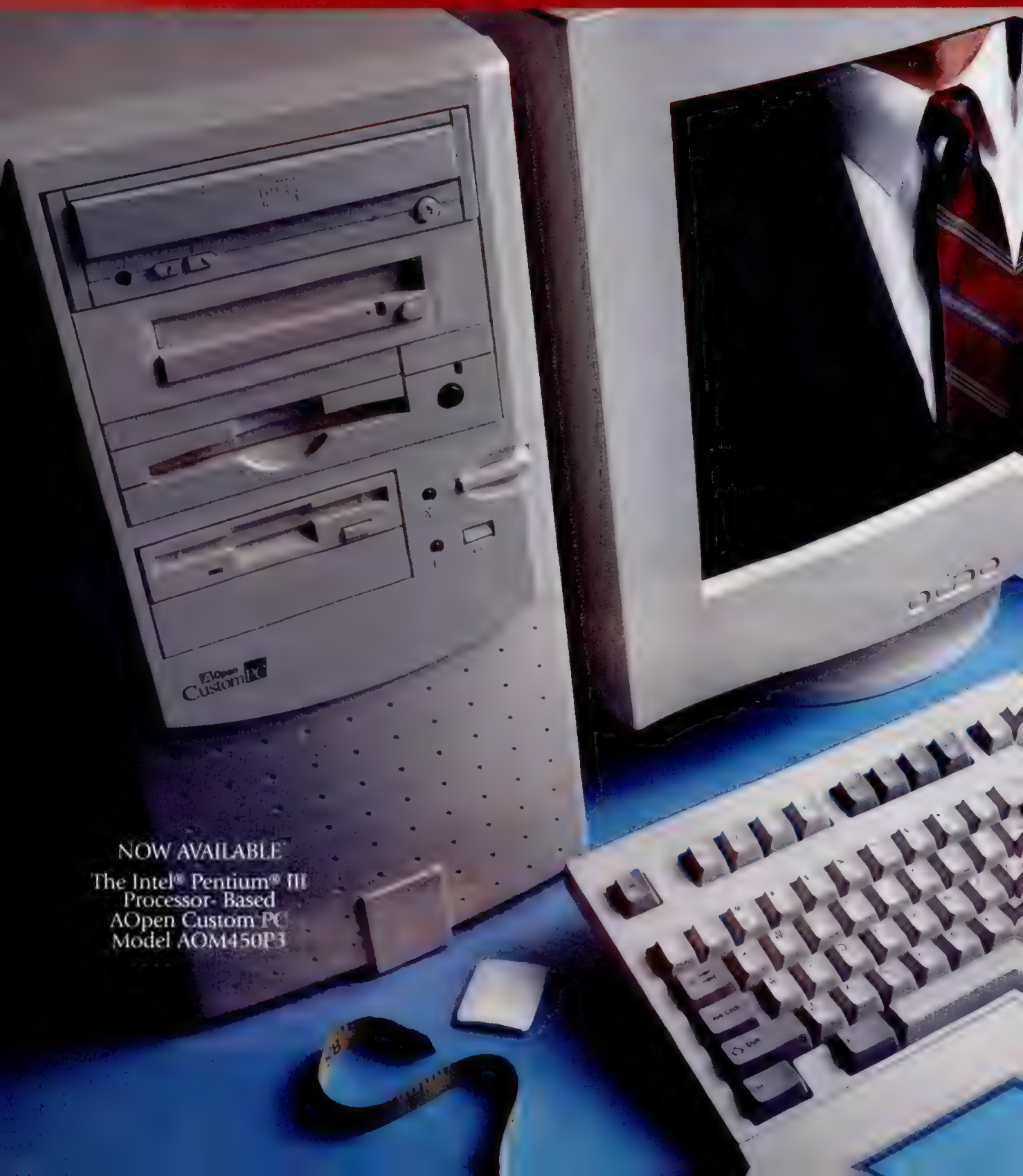
D-Link DHN-910 10Mb Phoneline Network in a Box

The D-Link DHN-910 10Mb Phoneline Network in a Box includes everything you need to connect two PCs together. The \$120 (street) kit includes two PCI

and we connected a PC running Windows 98 to a server running Windows NT without a hitch. D-Link provides toll-free technical support during business hours.

Once the network is set up, you can share and access resources such as drives and printers using the standard Windows dialog boxes. For Internet access-sharing, D-Link bundles a copy of MidCore's MidPoint Lite Internet Access Software, which functions as a proxy server and is fairly easy to install. To complete the installation, you must provide the server PC with a standard IP address and enter the settings for your e-mail and Internet news server. After we had the server up and running, all we had to do was point

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Wanting More from Nomad

By Tom Ponzo

Portable MP3 players, such as the Creative Labs' Creative Nomad Digital Audio Player, are fantastic little inventions. The Nomad's lack of an AM tuner (the unit does have an FM tuner) is one of our gripes, but we are still impressed with the player's small size and sound quality.

As we read your responses to our online discussion topic, however, it became quite obvi-

comment on the legal issues. One respondent was very appreciative of the advances in MP3 technology and was more than happy to hit the record companies where it hurts—in the wallet: "Huge record labels are about to lose a fat revenue stream. And it is about time, too. Who likes spending a 'mere' \$16 for a CD? I would buy more music if it were not so expensive."

Another reader also agreed. "This is the wave of the future, and if it takes a bite out of big business, then oh well. When CDs first came out, they promised us that once the medium became more widespread, they would lower CD prices. Well, I haven't seen much of that yet."

Never mind the issues surrounding copyrights and royalties—they're minor compared with wanting more features on these devices, which could boom to the early-1980s popularity levels of the Sony Walkman and all its competitors. A majority of our respondents, for example, focus their concerns on more storage capability.

The first portable MP3 player, the Diamond Rio PMP300 Portable Music Player (First Looks, January 19, 1999), which was introduced in 1998, shipped with only 32MB of RAM that was upgradable to 48MB, which translates to less than an hour of music. The Nomad also shipped with 32MB of RAM, but it was upgradable to 64MB, and it added the aforementioned FM tuner and a docking station.

A recent newcomer to the scene, the Sensory Science raveMP Media Player, is upgradable to 96MB of RAM from the unit's base of 64MB, and instead of an FM tuner it adds a voice recorder and a built-in phone-number memory bank.

Alas, the current crop of MP3 players does not yet have



AUDIO OASIS: The Nomad includes a docking cradle for loading MP3 files.

enough memory or features to satisfy our readers, as one respondent pointed out, "Most of the MP3 players out there only come with 64MB of standard memory. This means that unless you want to listen to the same 15 tracks all day, you can only be away from your computer for 1 hour until you have to fill your MP3 player up with songs again." Another added: "Unfortunately, 64MB is not enough for me. I want more storage for high-quality song[s]."

We tend to agree with the

reader who said, "I'll buy an MP3 player when Creative or a competitor produces a unit like the Nomad with the following additional features: more than 60 minutes of audio at CD-quality standard, an option for twice this capacity with the same audio quality, USB download capabilities via an AC-powered dock, a belt clip, and a decent set of headphones—for \$100." Let's hope that these options at this price are not too far away.

One thing our readers did not bring up is that you need to have a CD-ROM drive that is capable of digital extraction. If your CD-ROM drive is analog, you cannot rip songs from a CD, which we found to be a major frustration, especially if we wanted to store favorite tracks that are not widely available for download from the Internet.

But this is merely the first iteration of a new technology. As with the introduction of the Walkman and VHS videocassette recorders in the 1980s, there's a lot more in store for us. So, the ideal thing for all of us to do is wait for Moore's Law of Computing to take effect. We all want more from MP3 players. Eventually, we will get it. **PC**

Top Picks for Internet Audio

So you've got one of the hot, new MP3 players. The next step is to round out your digital music arsenal with the right software and sites. Here are our top picks from our recent feature story on Web audio and video ("Surf, Look, and Listen," September 21, 1999).

Streaming audio and video:
RealPlayer Plus G2

Jukebox software:
MusicMatch Jukebox 4.0

Tools: RealProducer G2

MP3-to-CD software:
CeQuadrat's JustAudio

Best programming guide:
RealGuide
(realguide.real.com)

MP3s: MP3.com

Webcasting: Broadcast.com

Internet radio: Spinner.com

Video: fastTV.com

Multimedia search: Scour.net

Also, be sure to check out RealJukebox Plus, an enhanced version of RealNetworks' jukebox software that wasn't ready in time for our September 21 story. For more details or to download some of these tools, visit our Web site at www.pcmag.com.

ous that you want more, a lot more. This isn't to say that the Nomad (First Looks, September 21, 1999) or any other portable MP3 player for that matter, does not live up to its hype. That's not the case at all.

A few of you, however, did

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Tell us what you think....

How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product each week and summarize your comments here. Following are some of your comments from our discussion of Creative Labs Nomad Digital Audio Player.

I'm pretty happy with my Nomad. I basically just listen to it when I'm working out. The sound quality is better than FM radio or cassettes, and there's no skipping or flutter. It would be better if the memory were larger, and the downloading of files to memory is sort of flaky at times, but in general I'm pleased. Of course, I bought mine for \$150 at Spring Internet World.

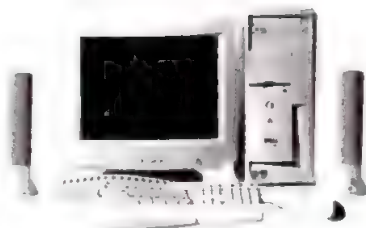
—Michael Bean

I have a RIO 300, and if it wasn't for the fact I got a killer deal on the Net, I wouldn't have purchased it. I'm very happy with it, but when you can buy a CD-RW for \$100 or \$150 to make your own CDs and a CD portable player with 40 seconds antishock for about \$50 to \$70, it's hard to justify a \$200 unit that will only give you 30 minutes of music.

—Ian Clements



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The Enemy Within

Are you online right now? If so, someone is probably snooping your system. Or will in the next couple of minutes. Or did a few minutes ago. Unless you run a server (and read the log files), or until you run monitoring software on your PC, you can't fully appreciate the number of probes and attacks that your

system endures. Even if you're on a local area network, your system is subject to the pokes and prods of your curious coworkers, eager to see what's on your hard disk or simply to see what they can get away with.

My awareness of attacks from the outside world began when I got a cable modem back in 1998. @Home's security back in those pioneering days was close to nonexistent. I could see my neighbors' systems, and they doubtless could see mine, even if we couldn't necessarily get to one another's hard disks. I could peruse the files on @Home's proxy server and caching server. My fixed IP address was there for all the world to see—and probe. Of course, the @Home/Comcast installation instructions were explicit: Turn off file and print sharing, and leave it off. But I had multiple machines at home and wanted to continue to network among them, even if one was connected to a cable modem.

In the course of testing a variety of hardware and software products that would share my fast connection and protect my machines from the outside world, I started looking at the activity logs that some of the products provided. I was appalled at what I saw. Scanning software was attempting to hook up with my Client for Microsoft Networks (NetBIOS). Port probes were looking for servers that they could exploit, trying to log on to telnet, SMTP, POP3, and other services. I've run a few scans of my own, and finding unprotected machines with cable modems or DSL lines is depressingly easy. Port scanners are readily available for download, but before you play with one, be aware that sniffing ports on a server is rude behavior, which will often be reported to your ISP and could cause it to close your account.

Finding an unprotected or exploitable server is the Holy Grail for hackers, however. Spam can be forwarded from a compromised server in mind-boggling profusion, hiding the source of the original mail. Servers often have password files that can be the key to other servers and countless user machines. User machines can be harnessed for a nasty

new kind of denial-of-service attack, where multiple machines attempt to contact the machine under attack, coordinated by a central machine that hopes to swamp the attacked machine's defenses.

Things are no better with client machines on the LAN at work. If you make your TCP/IP connection to the Internet through the LAN, your machine may be subject to port probes from the outside, since some systems simply pass them through. Even if your network is behind a firewall, as it should be, you can easily be hacked by your fellow employees. The firewall offers no defense against your coworkers. So if your machine is NetBIOS-enabled, other employees will be able to see your machine and create a share session.

If you have file and print sharing turned on, they'll have free access to your printer and the contents of your hard disk. Even if you've set a password, an enterprising attacker can just attack it with a cracking program. Since Windows places no limit on the number of failed log-on attempts, the cracker will eventually succeed. Worse yet, your machine won't even tell you that the invasion is in progress.

The easy solution to this problem is to disable NetBIOS functions and unbind Client for Microsoft Networks from your LAN adapter. You can set up a workgroup name that will exclude other machines, but it too is subject to cracking, as above. As I said in my previous column, I think it's just a matter of time before all users run personal firewall software on their systems, just as they run virus checkers today.

Server security is a job for high-performance standalone firewall boxes. SOHO LAN security can be done with hardware or software, but I prefer hardware, such as the MultiTech, BeadleNet, and SonicWall routers. Personal firewalls are software. We've had good results with AtGuard and BlackICE Defender, among others. Meanwhile, you can give your machine a security checkup at www.grc.com/ShieldsUP!, a site that noninvasively tests your configuration for common weaknesses. The data you save may be your own. **PC**



It's just a matter of time before all users run personal firewall software on their systems.

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The Killer App Gap

Advancements in desktop computing have historically arrived with advancements in technology. In the 1970s, the first desktop PCs let us do word processing and save documents on floppy disks. With the advent of the hard disk, the database manager became practical. The laser printer opened up

desktop publishing. High-resolution color screens gave us draw programs and Photoshop-type apps. The key to predicting a killer application comes with understanding what opportunities change represents. The Web browser was such a killer app that Microsoft bundled it with the operating system and claimed it was part of the OS! There are a lot of great new technologies and no serious new killer apps. I call this the killer app gap.

Predicting killer apps is difficult, until they come along and successfully kill the market. Right now all the attention is on the Internet, and all applications seem to be Net-based. Although the action on the Net is noteworthy, much of the new technology being developed and some of the changes found on the PC are being ignored. This list is just the tip of a huge iceberg.

44X CD-ROM drives. Actually this applies to any high-speed CD-ROM drive. Once the speed got past 8X, there seemed to be no particular use for higher and higher speeds. Why can't someone take advantage of these new high speeds?

CD-ROM burners. These devices are now dirt-cheap and are great for backing up files and saving photos. But I'm amazed at how little CD-ROM burning I do. One of the hot uses is burning audio CDs or moving bootleg MP3 to WAV to CD-R. That's hardly a killer app. In fact, it's illegal.

DVD drives. What have they brought to our little world? Movies you can watch on your PC.

Massive hard disks. I'll have 50GB on my PC any time now. And the killer app that has come from this capacity is still waiting to be discovered.

Flat-panel displays. Maybe this is a stretch, but isn't there something cool that can be done with flat panels that we couldn't do before?

LCD projectors. I love these things, but they're mainly used to show PowerPoint slides or TV shows. They have to be useful for something else.

Gigabit Ethernet. Even 100-Mbps Ethernet has not produced a killer app. The modern network has produced convenience and the ability to share

the Internet on one connection. Some people reckon this to be a killer app. I don't. Perhaps the networked game is the killer app here.

Cheap tethered cameras. All the camera guys have brought them out. But usage seems scattered. I've had a camera hooked to a computer on and off over the years, but I find no compelling application that makes me want to hook one up at the moment. Maybe an improved NetMeeting (which I find to be a tedious system) would help.

Cheap color/photo printers. Not that these printers aren't selling like hotcakes. But as with everything else on the list, I could live without them.

Tethered Palm computers. I love the tethered Palm computer synchronizing with my computer, and this thing does sell well. Maybe this is a device and killer app evolving. If that's true, the tethered Palm is probably the only thing on the list that is hot. But is there an underlying killer app that's anything more than a glorified address book? Or is that, indeed, the killer app?

DSL/cable modems. There's no doubt these are popular because they let you navigate the Web and download faster. But where is the associated killer app?

Flash ROM. This technology has found its way into digital cameras. Maybe the transition from film photography to digital photography is a killer app in itself, just as the transition from handwritten to electronic spreadsheets revolutionized accounting. Perhaps I'm not seeing the killer app right in front of me. A simple digital improvement is in itself a killer app. But it seems dull and nothing like desktop publishing, for instance.

There are only so many people in the world who can conceive and develop a killer app. From what I can tell, they're all being lured away by the Internet and its promises of overnight success. This alone is creating a huge killer app gap. I suspect that once the Internet economy settles down, focus will return to these new devices, and new killer apps will emerge.

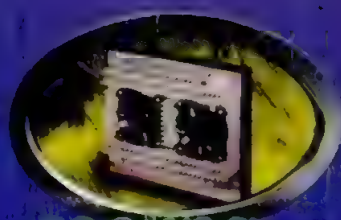


There are a lot of great new technologies and no serious new killer apps. I call this the killer app gap.

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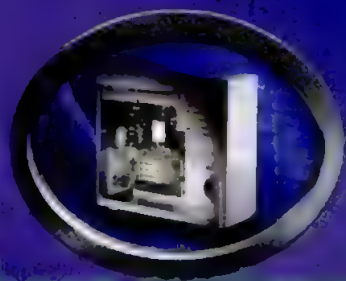
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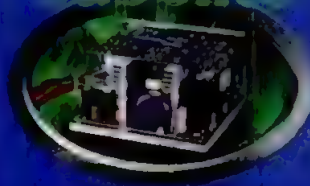
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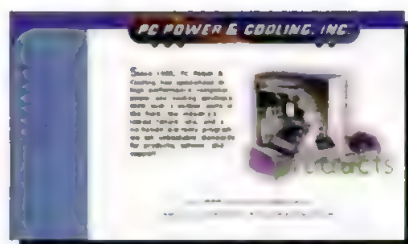
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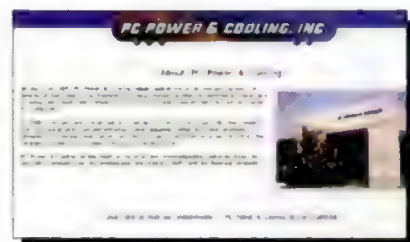
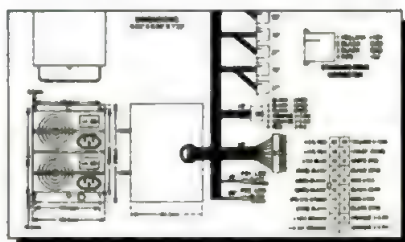
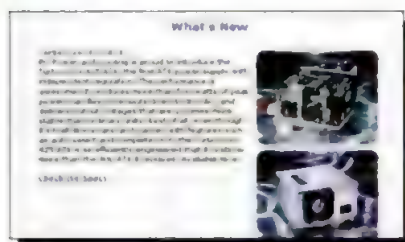
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INSIDE TRACK

Intel Shenanigans or Coincidence? Dept.: You have to wonder whether Intel is **freaked** about the AMD Athlon chip and its faster-than-Intel speeds. Sure it is. According to at least one report, vendors in Taiwan are skittish about producing a motherboard for the chip, afraid that Intel will restrict them from licensing their various socket and slot technologies. Apparently, many of the Athlon boards coming out of Taiwan have **no logo** but are made by famous board makers that fear for their businesses.

Meanwhile, the Taiwanese designers are annoyed at Intel for another reason: the i810-e and upcoming 820 chip sets used to support the Intel microprocessors. They hate these chips. When I attended the recent System Builders Summit, this was one of the most discussed issues. One board maker told me that once the i810-e chips came out **there was a run on the older motherboards** that utilized the 430FX chips, which these guys apparently love. They wanted Intel to keep making the old chip sets. The designers are particularly annoyed by the high integration of the 800 series, especially the mediocre graphics subsystem.

The motherboards using the alternative **Via chip set** are now the ones these guys are switching to in an attempt to avoid the new Intel support chips. Meanwhile, the first board makers to build i820-based boards found that they all had to be recalled. Some foul-up now forces Intel to reset its timetable for the release of Coppermine, unless Intel wants to run Coppermine on the old 810 chip set, which everyone hates. **The winner** in all this is Via Technologies, a company that has been in a **beef** with Intel for some time.

Buzzword of the Month Dept.: I was reading about how Motorola was promoting its new system-on-a-chip strategies and recalled a cooler concept I found out about at a recent Fabless Semiconductor Association meeting. It's called package-level integration. Instead of trying to jam two or three IC designs on a single wafer and make them all work, you take the separate devices and stack them on top of each other, making a **fat-top-looking** thing. The key to success is in packaging the device to make sure everything interconnects properly and doesn't overheat. Of course, this idea **isn't new**. When the IBM PC/AT first came out, IBM was gluing memory chips on top of each other. It was hilarious.

Breakthrough or Just Progress? Dept.: I'm amused at how quickly the CMOS camera faded. (That digital camera that is supposed to use cheap CMOS memory as an image sensor.) Where is it? Fuji, a leading developer of CCD, technology claims to have **invented a next-generation CCD** that sports honeycomb-shaped photodiodes. This new design is said to give a 1.9-million-pixel array the actual resolution of a 3-million-pixel conventional

CCD. All sorts of other improvements are part of the design, including improved signal-to-noise ratios and better sensitivity. It's called a Super CCD, and the architecture will allow it to **scale to 10 million pixels**. This should give it the resolution of a 15-million-pixel conventional CCD. And apparently, because of the design, the Super CCD can be used in a smaller camera than anything designed thus far. I've always said that at 8 million pixels, you won't be able to tell that you're looking at digital photos and not film. The best news is that this thing is ready to ship. Yes, Virginia, film is dead.

Here Comes Another New Technology Dept.: Over the years, this column has followed the advances of the disk drive business and, in particular, the GMR (giant magnetoresistance) effect that has made it possible to buy a 20GB hard disk for \$180 at Costco. Apparently, things that have been learned from this technology are going to be applied to semiconductors with a **new type of nonvolatile memory chip technology** called a *magnetoelectronic device*. Instead of dealing with electron charge, these devices **focus on electron spin**. According to *Electronic Engineering Times*: "More important for the future of electronics is the possibility of integrating GMR materials into standard CMOS processes. For example, Honeywell researchers demonstrated a CMOS non-volatile RAM chip using integrated GMR materials in 1997. IMEC researchers are investigating gallium arsenide-based 'diluted magnetic semiconductor' materials that produce effects such as hot electron spin and spin injection across an interface. The latter property is leading to transistors with magnetically activated gates." Will these developments ever end? Apparently not.

Underreported Microsoft Activity in China Dept.: The Chinese have found out what Microsoft's secret "Venus" project was, since it's being rolled out there as part of Microsoft's strategy to head off any government-funded competition in that country. It's described as an information appliance running Windows CE. I'd love for someone to e-mail me a picture of this thing (picture@dvorak.org). From what I can tell, it's **some sort of WebTV-like device**. But unlike WebTV, it apparently has applications that run on it, too. This sounds a little like a game machine or an old Apple II kind of deal, with a computer that sends out an RF signal rather than a video-out or XGA signal. Let's face it: The tons of TVs sold in China don't come equipped with a lot of video interfaces. The Venus also plays VCDs and DVDs. It will be contracted to a variety of Chinese electronics makers, using a distribution/licensing model once employed by 3DO and still used by WebTV. The price is said to be between \$150 and \$250, or about one month's salary. **PC**

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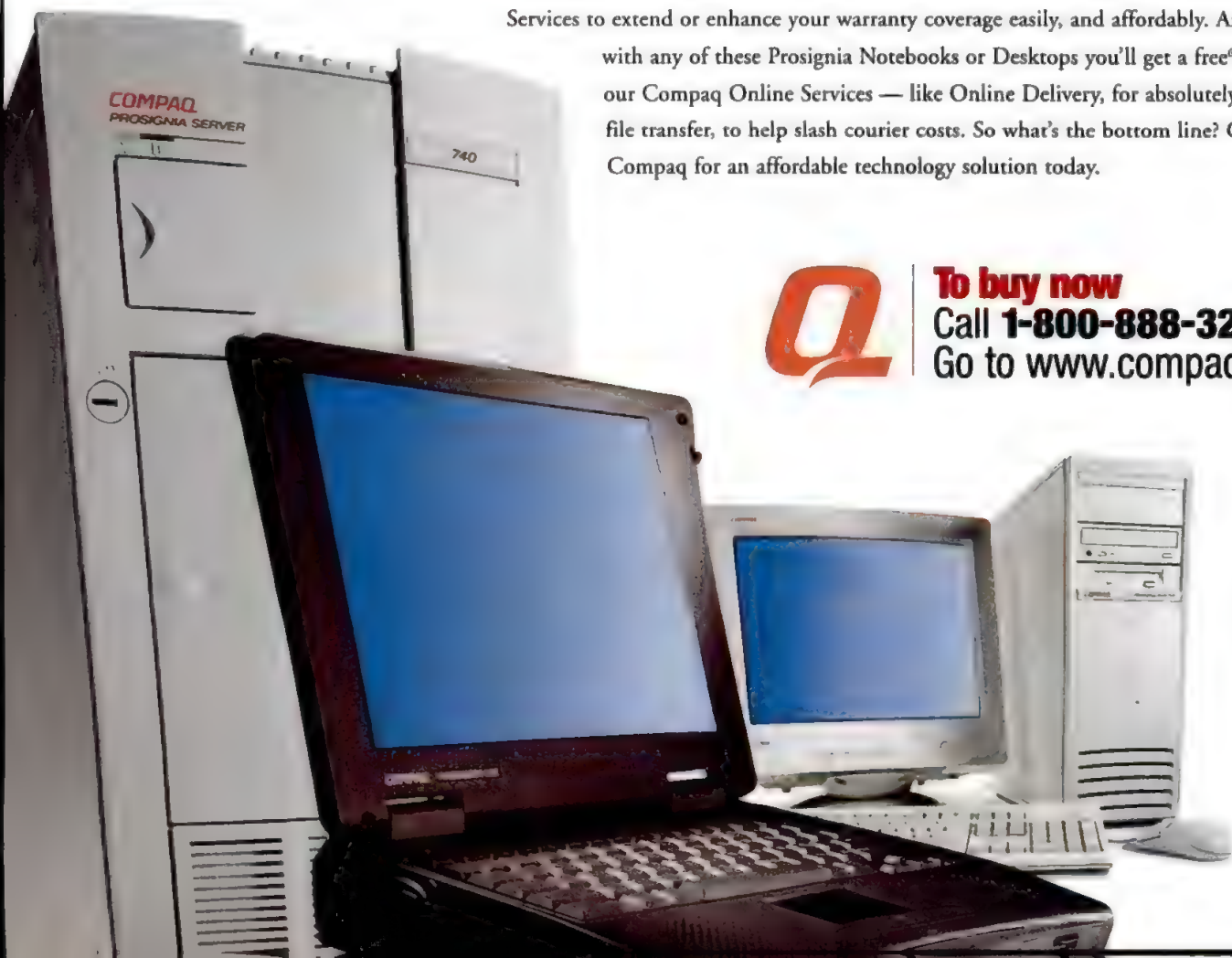
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The Best of the Best

Last year around this time, I started awarding "Jimmys," virtual trophies in an annual virtual awards ceremony for what I called PPPs—the Practically Perfect Products I'd seen during the preceding year. Over the course of a year, all of us at *PC Magazine* work with a lot of new products. Too often, our lists of

what's wrong with them—or at least, what we'd change—are even longer than the lists of what's right.

The PPPs defy that model by approaching perfection. *Approaching* is the key word here: I can think of very few computer products I've used over the past 20 years that I'd call truly perfect. Almost always some tiny thing or several not-so-tiny things pop up with the use of a product over time, spoiling that "perfect" label.

But practically perfect is rare too: those products that almost make it to perfection, with flaws that are, in the end, just not very important.

Remember how subjective all this is. What I find practically perfect Bill Howard might find fatally flawed. That's why I call these awards the Jimmys; they're one man's opinion. But it's an informed opinion, and thus, I hope, this will be a useful list for you.

Hardware. Last year, I tagged the air-filled protective pouches in the exceptionally good Codi Air-Pro series of notebook bags (<http://codi-inc.com>) as a prime reason for its Jimmy award. This year, Codi has come up with more great new designs. But I've also found an industrial-strength competitor: Brenthaven (<http://brenthaven.com>). Both its tough, shock-resistant Topload case and its Slim case earn 1999 Jimmys.

Both Brenthaven cases—which have the most comfortable carrying handles I've ever seen—are available in ballistic nylon as well as gorgeous, soft leather. Leather sounds like the obvious choice if you want something elegant, but remember that ballistic nylon weighs a lot less. I like the large Topload in lighter nylon, but I prefer the Slim in leather, since there's a lot less material there. *What I'd change: Nothing.*

Though Hewlett-Packard's laser printer business is booming—PD Intellect says that in 2Q 1999, HP garnered a stunning 65.4 percent of all dollars spent in the U.S. on computer printers—NEC (www.nec.com) has been quietly pulling ahead in price and features, especially in the low- to middle-price market. This year's NEC SuperScript 1800 is the best example: a

relatively compact laser printer with stunning, 1,200-by-1,200 output quality, delivering 17 pages per minute, with built-in duplexing—for \$750 (street) or so. That's unheard of and makes the 1800 an obvious Jimmy winner. *What I'd change: Nothing.*

The sensational IBM Deskstar 22GXP hard disk (www.storage.ibm.com) delivers 22GB of storage, at 7,200 rpm, for about \$200 (street). Fast, reliable, cheap—a classic Jimmy winner. *What I'd change: Give it even greater capacity.*

Sometimes PPPs win by adding "why didn't they think of that before?" features to underlying quality. The APC Back-UPS Pro 500 USB (www.apc.com) is a good example: To the right runtime capacity for most PC users and APC's great power-monitoring software, this unit adds painless USB connections and a convenient sloping-top design that makes it easier to connect and disconnect equipment than older designs that hide everything on the back. A big Jimmy winner. *What I'd change: Nothing.*

Software. The new Microsoft Encarta World English Dictionary (<http://encarta.msn.com>) gets a Jimmy, as the most useful electronic dictionary I know of. Microsoft took some flak when the print version appeared earlier this year; despite the huge team of lexicographers who worked for years on this reference tool, some errors and omissions inevitably crept in. The real question: Is Version 1.0 of the Encarta dictionary worth buying now? I say yes, emphatically. *What I'd change: Add the ability to install it on my notebook's hard disk so that no CD (and CD drive) is required.*

I'm a big fan of voice recognition software, and this year brought the best ever: Dragon Systems' NaturallySpeaking 4.0 (www.dragonsystems.com). Quicker and easier to train and with high accuracy, NaturallySpeaking 4.0 is a joy to use—on a fast PC. Tip: No voice recognition software makes sense on less than a 400-MHz Celeron box. *What I'd change: Give it faster processing, even greater accuracy.*

Microsoft Publisher 2000 owns the low-end market, and for longer print publications, Adobe Page-



This was a great year for new products, especially if you get past the big names in the PC business.

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Jim Seymour

Maker or FrameMaker and QuarkXPress are better choices. But for speed, quality, and raw design power for most midrange publishing work, the new Adobe InDesign—the best new PC software package I've seen in at least two years—is the choice (www.adobe.com). Exquisitely detailed type handling, a powerful but clean interface, and tight integration with Adobe Photoshop and Illustrator earn InDesign a Jimmy. *What I'd change:* Add the capability to write QuarkXPress files back to QuarkXPress format, and cut the price by \$300.

Paint Shop Pro's big revision was 5.0 in 1998; this year's leap to 6.0 was smaller but still significant (www.jasc.com). Overall, PSP has become the universal image editor. If still a bit short of Photoshop—just a bit—PSP now delivers the right feature set for 95 percent of PC graphics users. From well-implemented layers to direct hookups for more than 100 digital cameras, with great ease of use and an almost unbeatable price (\$99 direct), PSP 6.0's a Jimmy '99 winner. *What I'd change:* Give it better vector/raster tool integration.

Online. The sophisticated search engine and information publisher Northern Light Technology (<http://northernlight.com>) wins a Jimmy for its stunning depth and reach. Other good search tools, from Google to GuruNet, appeared or were improved this year, but Northern Light has become the best of the best. *What I'd change:* Nothing.

The Encyclopædia Britannica (www.britannica.com) finally got it, and this year the site dropped subscription charges for access to its wealth of information. The best encyclopedia ever—richer if duller than the competition, in a contest where depth beats style—Britannica.com is free, and it's a Jimmy winner for 1999. The older site (www.eb.com), with a wealth of information resources beyond the encyclopedia, remains a paid site intended mainly for institutions and serious researchers. *What I'd change:* Give it better screen design.

This was a great year for new products, especially if you get past the big names in the PC business. May the new millennium bring us even more riches like these. **PC**

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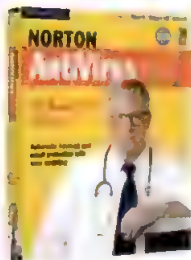
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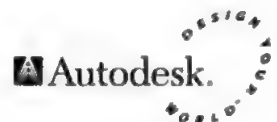
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Progress? Not!

"10, 2, and 4." That was the Dr Pepper slogan throughout the thirties and forties, urging you to drink the peppery cola three times a day. Dr Pepper should complain about Microsoft's concept larceny, because Windows seems to crash on my PC at 10:00, 2:00, and 4:00. Sometimes more often.

When I reflect on the past year and decade, I'm amazed at how much computers—and then the Internet—have changed our world for the better. That's what I think about occasionally and what I should be grateful for (along with the incredible gains in quality of life brought about by technology—nobody worries about the kids getting polio in 1999). Mostly, though, I think about how screwed up things still are. Let me count some of the ways I've been annoyed in the past week.

A couple times a day, my PC crashes. And at least once a day, I do a voluntary restart as system resources vanish. I don't care if Windows is at fault or if the applications are. I'm still aggravated.

Twice in the past week, I've told Windows to hide the taskbar—that little bar across the bottom of the screen full of running, want-to-be-running, and background-running programs. It eventually came back. Meanwhile, the system tray—full of programs that believe they have the divine right to be running in the background at all times—grows bigger, and resources grow lower. Not all these apps asked permission (at installation) to be put in the tray.

Once in the past week, my notebook froze when I pushed the remove-from-docking-bay button. Twice, it refused to go into short-term suspend. A third time, it appeared to suspend, but when I took it out of my bag 15 minutes later, it was blazingly hot to the touch—meaning it had either hung or failed to suspend. Each time I pushed the separate suspend-to-disk ("hibernation") button, the notebook beeped and did nothing; that feature had stopped working a month ago. Twice, when I put the notebook into the docking station and did a cold start, it refused to recognize the docking-station LAN adapter. Twice, when it did find the LAN card, it didn't recognize the other PC on the LAN for several minutes in the Network Neighborhood browser, even though a forcible attach-remote-drive shortcut found the other PC instantly.

On a trip to Florida, my plane spent more than an hour taxiing, then climbing above 10,000 feet and descending again, during which I couldn't use my note-

book. The airlines say *some* computers *might* interfere with navigation, so better safe than sorry. Now we have reports saying there's no evidence that cell phones interfere with aircraft navigation.

I installed Microsoft Office 2000 before my trip. I agreed to a most-common-options install, about 189MB worth of files. Somewhere en route to Florida, sans CD drive and Office disks, as I was editing a file, the paper clip popped up and told me I needed to dig out the Office CD, so it could install the hyphenation dictionary. *Excuse me.* Hyphenation is not something I think of as possibly useful for word processing: It's a core function.

Before my trip, LapLink, the file-transfer program, was working fine on my desktop PC—except it asked to test screen blanking each time it loaded, and it crashed when I unplugged the USB connector. When I came back, our IT department ran a Y2K remediation program on my desktop. After that, LapLink didn't work at all. I tried to connect over the parallel port and over a wireless LAN. No luck. I re-seated the USB cable. I inserted the cable into the second USB jack. Still didn't work. I then installed the current LapLink 2000. It didn't work. I swapped the USB cable again. LapLink then worked.

I unplugged my desktop PC's parallel-port scanner temporarily. The scanner driver continued to try to locate the scanner and load, unsuccessfully, and created a loop that stole half my PC's clock cycles, according to my system resources monitor.

Remote dial-up failed to connect one morning (after a dozen attempts), even though the remote server's modem answered. It had worked the night before, and it worked the following night. Why? As an editor, I'm curious; as a user, all I care about is that it didn't work, and it should have.

I love fast computers and hot new software. But if you gave me a choice between a Pentium II running at *any* speed, with stable, well-behaved software and operating system, and a PIII/700 with today's software and Windows, I'd take Old Faithful any day. Slow and steady wins many a race. **PC**



As an editor, I'm curious; as a user, all I care about is that it didn't work, and it should have.

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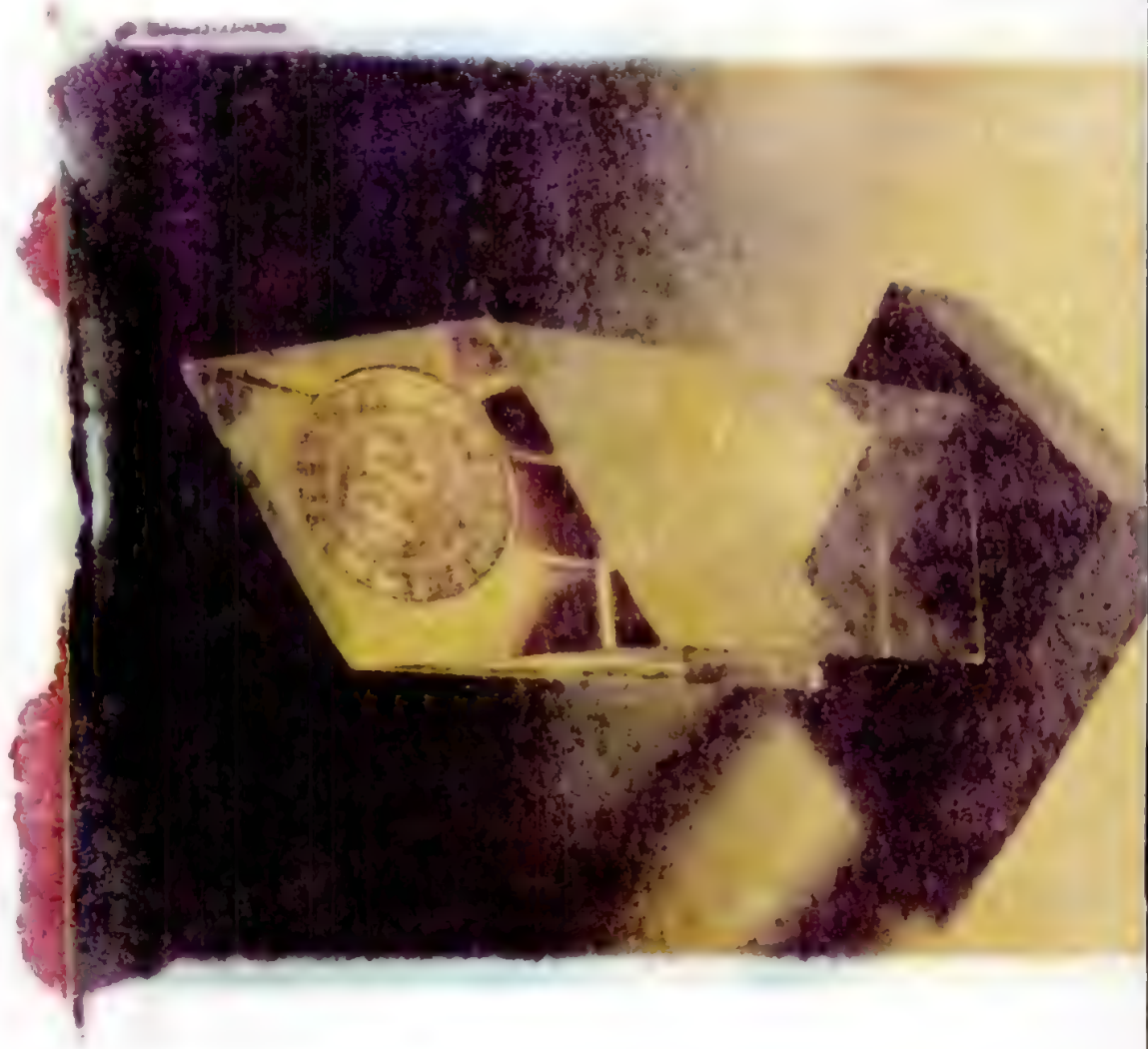
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Cover Story



technical excellence awards

In the Internet era, it's fashionable to say that technology is moving faster than ever. We're seeing more new companies with new products, services, and Web sites. But what about purely technical breakthroughs?

That's the question we try to answer each year as we choose the winners of our Awards for Technical Excellence. We look for new technologies, new concepts, and major advances in existing product categories. In some cases, we recognize whole new businesses and ways of working. In others, we see ways to make our existing tools work better.

For these awards, our editors, senior lab staffers, and

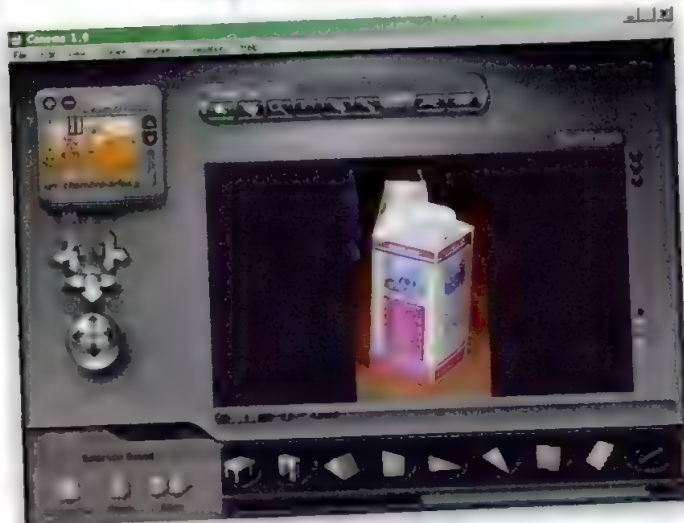
senior contributors spent weeks debating the merits of the past year's new products. We started out with a list of hundreds that shipped in the year ending September 30. We then narrowed it to 33 finalists, from which we chose the winners.

Some choices indicate the tremendous advances in tiny devices that let you connect to corporate LANs, intranets, and the Web from anywhere. Some show new technologies for using the Internet, managing applications, and making our lives more productive. Some make PCs work faster; others point the way for new design. Any way you look at it, 1999 has been an amazing year. Read on and see for yourself. —*Michael J. Miller*

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MetaCreations' 3-D Web Tools: Canoma and MetaStream

METACREATIONS CORP.'S technically excellent products for Web graphics designers complement each other so well that they deserve to share an award. MetaStream, a free download from MetaCreations' Web site, is new streaming 3-D technology that Intel and MetaCreations developed. The technology provides a format and browser plug-in for viewing Web images from every possible angle. The software lets you zoom, pan, and rotate 3-D graphics such as those at the Web sites of LEGO MindStorms (www.legomindstorms.com), NASA's Shuttle Small Payloads Project (sspp.gsfc.nasa.gov/3d/), or nextdimension (www.nextdimension.de). The big benefit of this technology is that it scales viewing performance to your system and Internet connection, giving you instant, unfettered control of the image.



Canoma is the natural companion to MetaStream and a technically excellent product in its own right: It takes regular 2-D digital photographs and turns them into photo-realistic 3-D images. All the software needs is a photo subject shot from various angles. It draws an outline around each image and automatically joins the series to create a single 3-D image. We think Canoma is great, because it simplifies the task of creating a virtual object from a two-dimensional image.

MetaCreations will soon deliver a new technology called MetaFlash for 3-D object creation from digital photographs. It uses a special flash unit mounted on a digital camera to capture and create 3-D objects as you photograph them—and it's an example of why we think MetaCreations is not going to rest on one or

two technologies. The company's full line of Web tools is exceptional, and products such as Bryce 4, Carrara, and Poser 4 prove the point. Bryce 4 builds 3-D worlds from the ground up; Carrara adds dazzling special effects, and Poser 4 generates animated characters. Place any or all of these tools in the hands of a professional Web designer and the possibilities are virtually endless. (MetaCreations Corp., Carpinteria, CA; 800-846-0111, 805-566-6200; www.metacreations.com.)

Amorphium

Play Inc. has a history of developing graphics products that redefine its markets. Snappy, for example, brings video capture to the average consumer's desktop, and Gizmos delivers sophisticated presentation software in the guise of a desktop accessory. We think Amorphium has a chance of doing the same for 3-D modeling.

Several technologies distinguish Play's new 3-D modeling tool—above all, the Amorphium Graphics Engine (AGE), a remarkably fast rendering technology that manipulates objects in real time without relying on hardware acceleration. After that, we choose Amorphium's underlying mesh geometry. It provides extremely responsive screen updates, and it maintains its performance values even on older, slower systems.

Finally, we think Amorphium's developers put a lot of programming effort into hiding the mathematical underpinnings of the 3-D modeling capabilities. This is a big plus for new users and nonprofessionals. Instead of making you grapple with such features as NURB splines, vertices, and polygon counts when you first experience Amorphium, Play gives you features anyone can relate to. What's more, the detailing and texture features let you add life-like imperfections to perfectly artificial 3-D objects. Amorphium's real-world paradigms, which let you animate, paint, or sculpt the objects you create, keep the excellent technologies behind them invisible. (Play Inc., Rancho Cordova, CA; 888-888-7529; www.play.com.)

ThemeScape

Just as geographic maps can visually guide you to your destination or help you explore new places, information maps can guide you to documents or resources while exposing new information you may wish to view. ThemeScape emerged from the research efforts of the Pacific Northwest National Laboratory for a consortium of government intelligence agencies that wanted to relate huge numbers of documents based on common themes.

ThemeScape's key technology—Spatial Paradigm for Information Retrieval and Exploration, or SPIRE—provides a 3-D representation where the number of relevant documents available determines the height of a mountain on the program's information map.

Similarly, the proximity of one mountain to another is determined by how much the two information sources have in common. Thus, ThemeScape addresses three critical information needs: It provides general intelligence analysis, it provides new context by uncovering information buried in huge databases, and it provides a way to distribute information.

Cartia has created information maps built from as many as 750,000 documents. Its technology will be a real eye-opener for large organizations that may have lost sight of the value of their informational assets. (Cartia Inc., Bellevue, WA; 425-468-9020; www.cartia.com.)

We See Dollars MetaCreations has entered a partnership with Computer Associates International to develop MetaStream.com, a company that will create and market MetaStream e-commerce visualization

products and services. This is part of the companies' efforts to grab a share of the e-commerce market, which Forrester Research estimates at \$22 billion in 1999.

WINNER

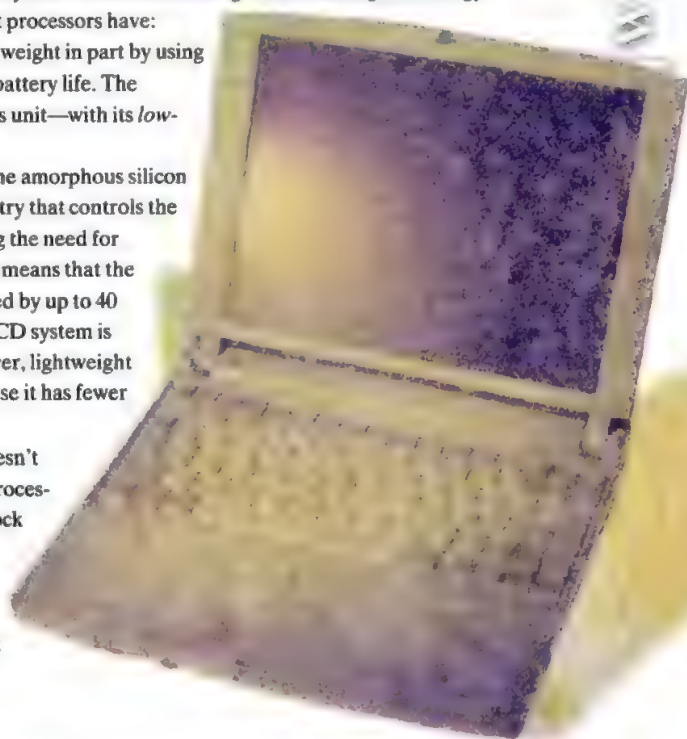
Toshiba Portégé 3110CT

INSIDE AND OUT, the Toshiba Portégé 3110CT showcases what Toshiba does best. The company integrates the advanced mobile computing technology that traveling businesspeople and professionals need. The fact that the machine has a cool-looking case isn't bad, either, proving that the company's commitment to excellence benefits mobile computer users. Toshiba didn't build the 3110CT with a silver-magnesium case to make a fashion statement; the company built it that way to make it light and strong. How light is it? At 3 pounds, the 3110CT defines the standard for ultramobile PCs.

The 3110CT isn't the only 3-pound notebook you can buy, but it's the first to use groundbreaking technology that addresses the problem many mini-notebooks with fast processors have: short battery life. Other mini-notebooks achieve their low weight in part by using lower-capacity batteries; this translates directly into poor battery life. The 3110CT preserves battery life—more than 3 hours with this unit—with its *low-temperature polysilicon* (LTPS) display.

Polysilicon can achieve higher electron mobility than the amorphous silicon manufacturers usually use in their LCDs. The driver circuitry that controls the panel is integrated on the polysilicon substrate, eliminating the need for externally mounted driver circuits. Driver integration also means that the number of components devoted to the panel can be reduced by up to 40 percent. And the number of connections needed for the LCD system is reduced by 95 percent. The result is a thin, bright, low-power, lightweight display that's more durable than traditional screens, because it has fewer connections and parts that can fail.

In fact, the 3110CT is so thin—at 0.8 inches—that it doesn't include a cooling fan for its 300-MHz Mobile Pentium II processor. To control heat, the system reduces the processor's clock speed when its temperature rises. Even so, the 3110CT's mobile computing power, battery life, and panel make it the most impressive ultramobile PC we've seen. (Toshiba America Information Systems Inc., Irvine, CA; 800-867-4422; www.toshiba.com.)



Apple Power Mac G4

Take a great design, make it easy to upgrade and maintain, and add one of the fastest PC processors available and you end up with a great system. That's what Apple has done with its new Apple Power Mac G4.

The machine is based on the Motorola PowerPC G4 processor (designed by Apple, IBM, and Motorola and manufactured by Motorola). The processor's breakthrough technology is the Velocity Engine, which Motorola calls AltiVec. The chip offers a more advanced architecture for handling vector processing than equivalent Intel processors do.

The Power Mac's technological achievements include built-in FireWire ports, two USB channels (not just two connectors but two buses), Accelerated Graphics Port (AGP) support for faster graphics, and a built-in antenna and wireless features for AirPort networking. Apple has retained a design that was originally used for its Power Mac G3, with a pull-down motherboard offering easy access to expansion slots and drives without tools. The combination yields a winning system for graphic designers, Internet content creators, and anyone who wants a high-performance PC. (Apple Computer Inc., Cupertino, CA; 800-538-9696, 408-996-1010; www.apple.com.)

IBM ThinkPad 570

IBM provides as much or as little portable technology as you want with the IBM ThinkPad 570. Versatile technology is the key benefit of this ThinkPad. With it you get the best of both mobile computing worlds: a 4-pound, 1-inch-thick notebook or a 7-pound, all-in-one system.

The lightweight version gives you 366-MHz Mobile Pentium II computing power with a built-in 56K modem and a high-resolution 13.3-inch screen. For an all-in-one system that's capable of replacing a desktop PC, IBM offers a 2-pound UltraBase and a 1-pound docking extender. The UltraBase fits beneath the ThinkPad 570. One side can hold the floppy disk drive or a second battery, and the other side can hold a variety of hot-swappable drives, such as a Zip Drive, CD-ROM drive, or DVD player. The docking extender provides extra connections for plugging in PC Cards or hooking the unit up to office and home networks.

The computer's on-disk documentation includes a searchable system manual, and IBM provides software that helps anyone configure the ThinkPad 570—and anything that connects to it—easily and graphically. That's why this IBM notebook is one of the best. (IBM Corp., Somers, NY; 800-426-7255; www.ibm.com/pc/us/thinkpad.)

A Hard Case Magnesium alloy is the hot structural material for today's style-conscious notebook user. Automobile-industry demands for magnesium are expected to reach 100,000 tons a year in 2000.

Still, most of the metal goes into making cans, not cars or computer cases. Aluminum alloy used 44 percent of the magnesium supply in 1997, half of which went into beverage cans.

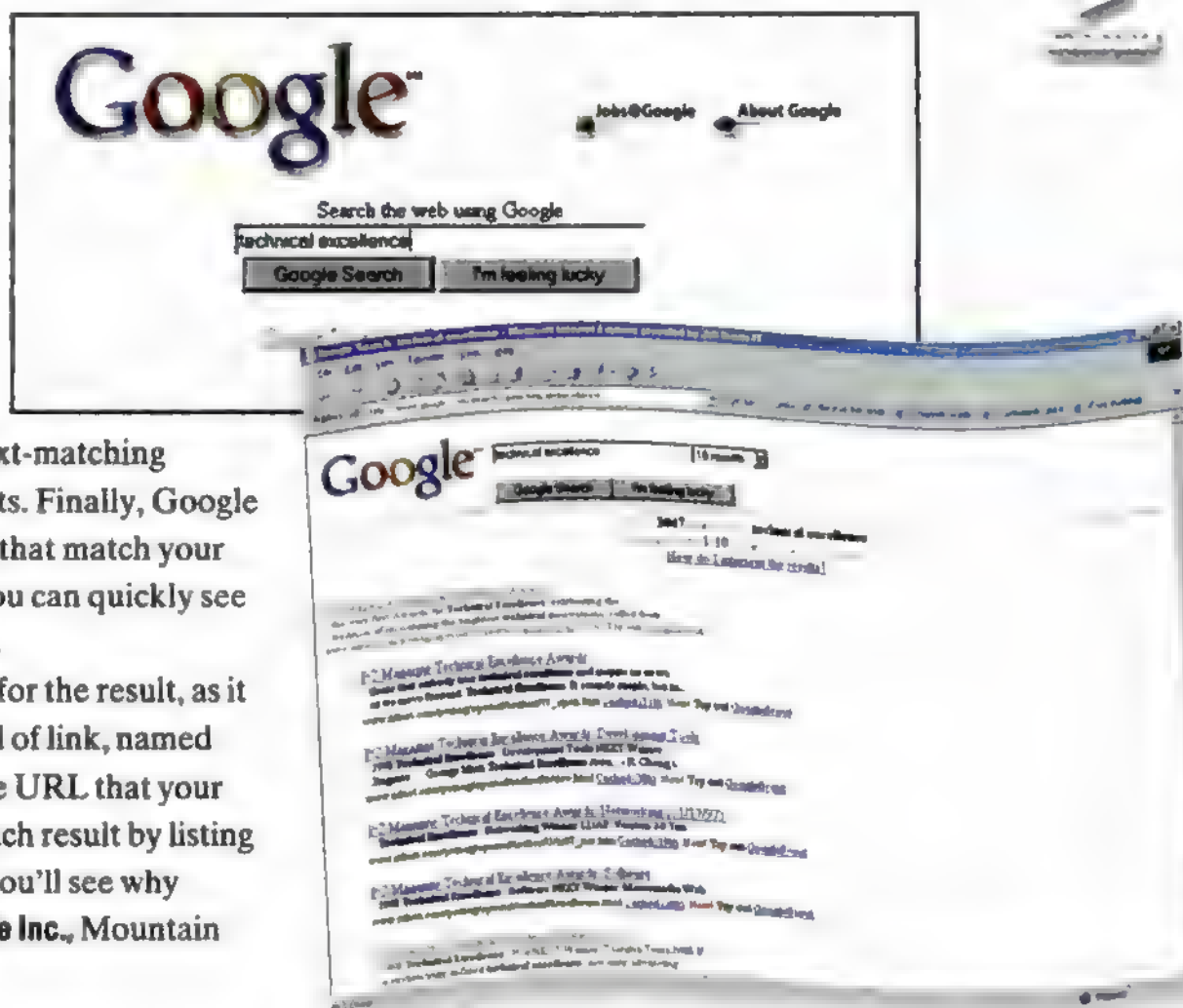
Google

IT DOESN'T TAKE MANY VISITS to Google to get hooked. And who can avoid getting hooked on a search engine that consistently returns good results? Query after query, it turns up the most relevant pages while displaying the results in a way that's easy to scan or read.

Though the Web site is barely a year old, we admire the work of Google's creators, Sergey Brin and Lawrence Page. The execution of their plan for building the site is superb. Take a look at "The Anatomy of a Large-Scale Hypertextual Web Search Engine," a paper they published at Stanford University, where both are Ph.D. candidates. Go ahead and try using their site to find it. All you have to do is type the title in Google's query box. The paper gives a complete description of the prototype for a large-scale Web search engine called Google. It also describes original information retrieval techniques, such as the PageRank technology responsible for Google's outstanding search results.

Using PageRank techniques, Google determines the relevancy of search results by analyzing the number of Web sites that point to any page returned by a query. The number of pages that link to a result influences its ranking first. Next, Google uses sophisticated text-matching techniques to improve the relevancy of the results. Finally, Google returns the search results with excerpts of pages that match your query, along with highlighted search terms, so you can quickly see whether a given site is the right resource for you.

Each search result also includes a cached link for the result, as it was indexed, and a link to similar pages. This kind of link, named GoogleScout, lists pages related specifically to the URL that your query returned. The idea is to provide depth to each result by listing additional pages with similar content. Try it and you'll see why Google is simply a smart Web application. (Google Inc., Mountain View, CA; 650-318-0200; www.google.com.)



Desktop.com

Desktop.com, a remarkable feat of JavaScript programming and a trend-setting Web development, is a virtual desktop alternative to Microsoft Windows, Apple's Mac OS, or any other JavaScript-capable operating system. It's not on the level of running all your applications from the Internet. But Desktop.com's technology provides a way for you to work with the most common PIM applications, such as e-mail, calendars, and to-do and contact lists, with the same kind of integration you would expect on a company network. It even kicks in some extra storage space where you can upload files.

As in the Palm organizer platform, there are lots of little add-in utilities and productivity applications, all of which run inside the browser-based Desktop.com environment. And the data or files these applications generate are stored on either the Desktop.com server or the application provider's server. This means that Desktop.com has the potential to keep track of the important details in our professional and personal lives while giving us access to those details from any computer with an Internet connection and a browser.

With a flexible applications manager and a growing list of new applications now being developed for it, Desktop.com is an almost irresistible service. (Desktop.com, San Francisco; 415-701-0200; www.desktop.com.)

Third Voice (Version 1, Beta 3)

Making e-opinions is a hot trend on the Web, and Third Voice provides new technology that lets you speak your mind regarding any site. You download the software and register with the Third Voice site; then, through a central server, Third Voice tracks where you are on the Web and stores the comments you make concerning any site you visit. Other surfers visiting sites that you've commented on can pull up your messages and add thoughts of their own.

Third Voice uses a threaded-message style to organize the comments, providing a familiar way to track the Web discussions. When you click the "Show Notes on this Page" button on the Third Voice toolbar, which travels wherever you go on the Web, tiny dots appear on each Web page where notes have been attached. The Third Voice toolbar also lets you filter what you see. It lets you hide notes you've already read, ignore public notes or notices, or avoid the inevitable spam. And Third Voice even provides recommendations as to where you should join Third Voice discussions.

Third Voice has potentially wide-ranging applications, from annotating and updating Web content to voting on issues. (Third Voice Inc., Redwood City, CA; 650-591-1200; www.thirdvoice.com.)

Zero Hero Google comes from the word *googol*, which was coined in 1938 by 8-year-old Milton Sirota, nephew of the American mathematician Edward Kasner, to represent the figure 1 followed by 100 zeros.

Milton also suggested the larger *googolplex*—a 1 followed by a googol of zeros, or as young Milton put it, as many zeros as you can write until you can't write any more.

WINNER

Analysis

A GOOD COMPUTER
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- MS® Works Suite 99 with Money 99 Basic
- MS® Windows® 98, SE
- 3-Year Limited Warranty*

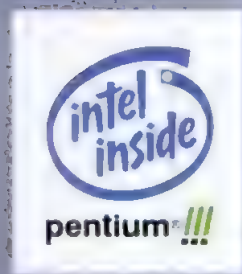
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3Com Palm V

TRUST THE FOLKS AT PALM COMPUTING to keep innovating on the side of smart design. Sure, the Palm VII delivers wireless e-mail, but the Palm V is faster and better-looking. That's why it wins our design award.

The 3Com Palm V is the flagship model of the classic Palm line, which are primarily personal organizers rather than personal communicators. Of course, the Palm's small snap-on modem will get you to the Internet. But the lack of instant connect-anywhere wireless functionality has not prevented it from attracting those seeking ever more convenient digital accessories.

With the Palm V, 3Com's Palm Computing division took the basic concept that made the earlier models so successful and made it thinner and lighter than ever. The designers slimmed down the Palm V's profile, while improving its performance, by building it around Motorola's smaller, faster DragonBall EZ processor. They also made it a bit sexy.

The Palm V comes with a flexible embossed-leather cover that slips into either of its two stylus channels, an elegantly simple design idea that lets the Palm V easily accommodate both right-handed and left-handed users. Because of its high-tech anodized aluminum shell and sleek profile, this became the organizer everyone wanted to carry in 1999. And its rechargeable battery keeps it going wherever you go.

Another design innovation: The Palm V's cradle provides data syncing and battery recharging at the same time.

Yes, other organizers cost less, have more memory, or offer more features, but the Palm V gives its owners everything they need—the latest Palm operating system, all the standard Palm applications, a sharp screen, infrared transceiving, quick cradle syncing, and all-around cool looks. It has

become the one to beat. (Palm Computing Inc., a 3Com Company, Santa Clara, CA; 800-881-7256; www.palm.com.)

Apple Power Mac G3

Many Apple success stories over the past year have more to do with its nontraditional computer cases and colors than complete system designs. The big exception is the Apple Power Mac G3, which shares a design with the Power Mac G4.

A far cry from the iMac, which rarely needs its case opened, the Power Mac provides the fastest access to the insides of a computer we've ever seen. Just lift a handle and a hinged door reveals everything inside. This simple feature makes expanding and upgrading the Power Mac a breeze. But it's more than just a serviceable system. The Power Mac G3 improves over previous Power Mac designs with the addition of FireWire and USB ports. Gone is the reliance on slow network and proprietary connections. Finally, Apple is incorporating computing standards that most of us live with and use.

The Power Mac G3 improves on the power and performance of earlier models, with a processor that's nearly twice as fast as a Pentium II and advanced graphics-processing capabilities. Plug in Apple's new flat-panel Studio Display and you'll have a system that anyone would want on the desk. (Apple Computer Inc., Cupertino, CA; 800-538-9696, 408-996-1010; www.apple.com.)

NEC Z1

This was the year of the one-piece desktop computer. Enticed by the success of the Apple iMac systems late last year, and encouraged by the growing popularity of flat-panel displays, computer makers have rushed to release all-in-one systems. But none of the PCs we've seen has been nearly as sleek and well designed as the NEC Z1.

It's the little things that set this system apart from the other all-in-one systems we reviewed in 1999, such as the Gateway Profile XL. Features such as a removable LCD panel, a wireless keyboard with integrated mouse, instant Ethernet connections, PC Card slots, a handful of USB ports, and a special peripheral connection on the back of the Z1's base really make the difference. Most of all, the design allows easy expansion, something the all-in-one PCs are not known for. And did we mention that it just looks good? It's neither a candy-colored computer nor a beige box but a stylish, smart-looking steel-gray system. (NEC Computer Systems Division, Mountain View, CA; 888-329-0088; www.nec-computers.com.)

Sweating Palms Worldwide, some 2,650,000 hand-helds were sold in 1998, with 3Com shipping over 65 percent of the devices. According to International Data Corp., the number of hand-held ship-

ments is expected to reach nearly 4 million devices for 1999, thanks mostly to the desirability of the Palm V. The new version of the Palm V, the Palm Vx, with 8MB of RAM, is further fueling the market.

WINNER

technical excellence awards network infrastructure

3Com NBX 100 Communications System

WHERE'S THE REAL VALUE of voice communications over IP networks? We think we've found it in the 3Com NBX 100 Communications System. The NBX 100 uses beautifully designed IP phones to provide voice and data capabilities over a single network cable connected to your desktop.

As an alternative to standard PBX systems, the NBX 100 offers economical scalability and a long list of features.

You get multiline business telephone sets with caller ID, an auto-attendant feature, voice mail, LAN/WAN connec-

tivity, and computer telephony integration built in.

Just think: You can carry your phone anywhere within your organization, plug it into the LAN, and immediately use all of its features. The system is both easy to use and as reliable as the best telephone system. In the future, the NBX 100 will be the basis for tighter integration of voice commands, authentication, and audio services.

This technology offers more than just pop-up information on the screen. And it holds loads of potential for organizations of all sizes. The technology behind the NBX 100 provides for real convergence of voice and data systems services—and 3Com's outstanding technical design is the best. (3Com Corp., Santa Clara, CA; 408-326-5000; www.3com.com.)



APC DP Series UPSs

They're big and beautiful, and they love the environment. Each APC DP Series enterprise-level uninterruptible power supply is designed to provide perfect power to server rooms holding dozens or even hundreds of servers. But the most impressive feature is their 98 percent power efficiency. That's unheard of for backup power systems. APC's patented Delta Conversion On-line technology makes such efficiency possible. These UPSs deliver great economy using this outstanding technology. (American Power Conversion Corp., West Kingston, RI; 800-788-2208; www.apcc.com.)

[Forecast]

Cisco 1750 Modular Access Router

The Cisco 1750 Modular Access Router is way ahead of the technology curve in delivering voice, VPN, firewall, and routing services from a single product designed for small and medium-size businesses.

The Cisco 1750 carries voice traffic such as telephone calls and faxes over IP networks with the same service features typically found only in higher-end products. And its four WAN links keep remote Ethernet and Fast Ethernet LANs connected to central offices. It's future-proof, too, since its modular architecture makes it a flexible powerhouse. (Cisco Systems Inc., San Jose, CA; 800-553-6387; www.cisco.com.)

Cheap Calls Internet Protocol (IP) telephony is expected to clock in at 2.7 billion minutes in 1999. IDC forecasts that voice communications across IP networks will reach 135 billion minutes worldwide by 2004. This translates into \$19 billion worth of service revenues.

Sounds Low According to a recent Frost & Sullivan information technology report, the world's wireless wide area network market is expected to increase from a 1998 level of \$4.11 billion to \$15.19 billion by the year 2005.

network standards

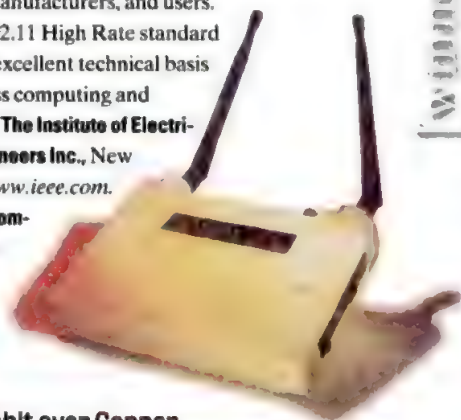
IEEE 802.11 High Rate Standard and the Wireless Ethernet Compatibility Alliance

WIRELESS LANs have been with us for a decade now, but fast wireless LAN equipment from one company actually communicating with wireless equipment from another is something new. With wireless networks finding wider acceptance in corporations, small offices, and homes, the need for greater compatibility is obvious. That's why the new IEEE 802.11 High Rate Direct Sequence specification is such a significant development in the maturation of wireless technology. This new standard provides the technical guidance for developing wireless networks that use the 2.4-GHz radio band and run at 11 megabits per second.

A critical contributor to this effort is the Wireless Ethernet Compatibility Alliance (WECA), a new industry organization

dedicated to certifying products for interoperability and promoting issues such as security that are important to wireless network developers, manufacturers, and users. Together, the IEEE 802.11 High Rate standard and WECA create an excellent technical basis for a new era of wireless computing and Internet connectivity. (The Institute of Electrical and Electronics Engineers Inc., New York; 212-419-7900; www.ieee.com.)

The Wireless Ethernet Compatibility Alliance; www.wirelessethernet.org



HomePNA 2.0

Last year the Home Phoneline Networking Alliance standard allowed 1-Mbps signaling over existing home telephone lines. This year, HomePNA's newest specification improves that by a factor of 10. The new 10-Mbps specification, based on work done by Epigram (now a division of Broadcom Corp.), offers backward compatibility and new capability.

The key to the technology is that it allows the networking of computers, peripherals, and appliances without interrupting existing phone services. Networking companies quickly mobilized behind this latest standard to deliver HomePNA 2.0 products at affordable prices. (Home Phoneline Networking Alliance; www.homepna.org.)

[Forecast]

1000Base-T Gigabit over Copper

We haven't reached the point where everyone needs a gigabit pipe to the desktop, but the Gigabit Ethernet standard (IEEE 802.3z) plays a big role between switches and links to servers. The fiber-optic cable links that Gigabit Ethernet usually requires are expensive and need special expertise to install. A recent IEEE standard loosens these restrictions.

The IEEE 802.3ab or 1000Base-T specification, ratified on June 28, provides a way to run Gigabit Ethernet over widely installed Category 5 UTP cable, making gigabit connections to desktops more practical. (The Institute of Electrical and Electronics Engineers Inc., New York; 212-419-7900; www.ieee.com.)



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BlackICE Defender

BLACKICE DEFENDER makes the solution to serious Web security problems personal. This intrusion detection and protection system shuts down access to networked computers at the point where it matters most—the individual computer on the desktop.

BlackICE installs on any system on the network, where it will wait, watch, and close down the ports if an intruder is detected. The software permits a good amount of personal control. Since it's not a global network security program, BlackICE provides desktop-level confidence choices, such as Trusting, Cautious, Nervous, and Paranoid. BlackICE also lets you select addresses that will be considered safe, while still displaying information about intruders and logging evidence of attempted break-ins.

A firewall is the standard means of protecting a company's network against attacks from the Internet. Such a hardware or software mechanism allows only specific traffic to pass from the Internet to an internal network. But this is maintenance-intensive: Holes can appear whenever new protocols and services are added to the network. Dial-up connections punch holes in an internal network's security screen, too, since they don't have to pass through the firewall or a proxy server.

What sets BlackICE apart from firewall protection is that it just works, and it doesn't require setting up a complex series of rules to tell a firewall what to do. The technology that makes BlackICE stand out is its built-in intelligence. The software is aware of more than 200 intrusion techniques, so when an attack is executed against a system, BlackICE detects it and blocks all access from the intruder's IP address. Like a virus scanner, BlackICE uses a signature file—which must be updated regularly—to detect hostile traffic.

BlackICE is an indispensable line of defense for home users who don't have firewalls. And it's an added layer of protection on the corporate network—not to replace the firewall but to stop intruders who manage to get past it. (Network ICE Corp., San Mateo, CA; 650-341-6886; www.networkice.com.)



Brightmail

Some of us get so many spam e-mail messages that it's a relief to know there's a service to turn to for help and support. Brightmail's approach to spam filtering is as interesting as it is welcome.

Brightmail Inc. operates a probe network that monitors e-mail accounts on the networks of 25 ISPs, including AT&T, Concentric Network, EarthLink Network, and Juno Online Services. The Brightmail probe network is designed to identify spam based on classic junk and unwanted e-mail characteristics, such as identical messages showing up in multiple ISP accounts.

People who subscribe to the service agree to have their e-mail routed through the Brightmail server, where each incoming message is compared with known types of spam. All messages identified as spam are removed from your mailbox and saved by the service. Deletions are followed by a message summarizing the headers of suspected spam messages. If you identify a message as having been incorrectly tagged as spam, you can simply log on to the Brightmail Web site and retrieve it.

If spam is a real corporate or personal problem for you, relying on the expertise and technology of professional spam busters makes a lot of sense. (Brightmail Inc., San Francisco; 415-365-6182; www.brightmail.com.)

GoBack 2.1

All the planning in the world can't prevent human error: Critical files are permanently changed or deleted every day at the accidental push of a button. Sure, regular backups help, but what happens when you're between backups?

GoBack can save the day even when Windows won't boot. Running beneath the operating system, GoBack continuously tracks disk activity. Since GoBack is time-based, rather than file- or task-based, it provides backup technology to restore or roll back your system to a working state. It doesn't matter if that working state was 5 minutes or 5 days before something went wrong. You can selectively restore individual files or the whole disk. The technology makes it easy to retrieve an earlier version of a damaged or lost file.

GoBack displays all recoverable file versions, which you can sort through and filter. But to retrieve multiple lost files—even those moved to and deleted from the Recycle Bin—GoBack provides a way of temporarily creating a mirror of a system's hard disk as it existed before the files were deleted. GoBack is no substitute for regular hard disk backups, but it improves the chances of immediately recovering lost files. (Wild File Inc., Plymouth, MN; 888-945-3345, 612-551-0881; www.goback.com.)

Hack Attacks For the first three quarters of 1999, the Computer Emergency Response Team (CERT) Coordinating Center logged 8,844 intruder activity incidents or network security attacks that it

investigated or issued advisories on. Among other techniques, these included virus attacks, network probes, password hacking, and the use of break-in scanning tools.



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technical excellence awards person of the year

Linus Torvalds

THE FINNISH INVENTOR and trademark holder of Linux, Linus Torvalds was no overnight success. The seeds of Linux were planted at the start of this decade. Within a year of learning Unix and C programming—and picking apart a Unix-like operating system called Minix—Torvalds began developing the operating system whose name was adapted from his own. Although Linux did not introduce the concept of open-source system development (that distinction belongs to BSD Unix, of which Bill Joy was the chief designer in the late 1970s and early 1980s), Linux is the most potent and popular leader of the open-source movement in 1999.

Torvalds continues to work on the post-Linux 2.2 kernel, and he clearly knows the role his operating system plays in the software development world. He has said, "The business model for software will evolve away from selling standard blocks of software such as Windows toward a future where software is customized to meet specific needs." Thousands of advocates, users, and programming contributors from around the world are making Linux's core technology the basis for systems and applications that advance the concept into the next century.

Since its first release in October 1991, Linux has evolved to support nearly all the features of a modern, multitasking, multiple-user operating system. And the companies distributing it include a who's-who list of the most innovative and powerful, including Caldera, Corel, IBM, Informix, Red Hat, and Sun. Meanwhile, details of Torvalds's day job with the industry's most secretive three-year startup—Transmeta Corp. in Santa Clara, California—remain a mystery. Its famous employee said in September, "The company has considered saying something at Comdex, or at least saying when we will announce something."

NATHANIEL WELCH



Fishing with Linux CyberYoda: How did the penguin become the Linux mascot? Linus Torvalds: Partly because I was bitten by a penguin. It was an open zoo. I made my finger look like a herring—and the penguin fell for it. —From an IRC chat on irc.msnbc.com

Heavy R & D Bill Joy is a member of the President's Information Technology Advisory Committee, which has recommended yearly funding of federal information technology research and development programs of \$2.7 billion by fiscal year 2004.

lifetime achievement

Bill Joy

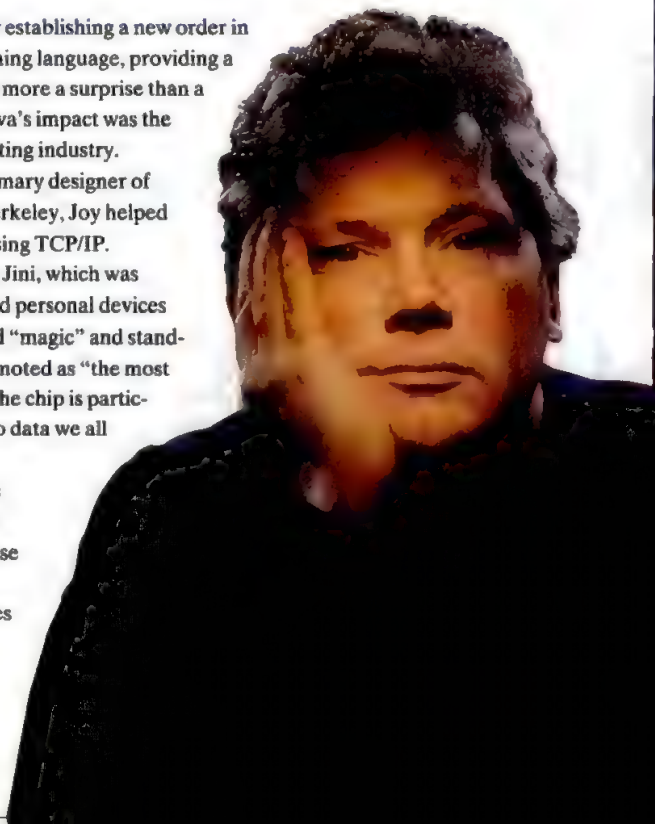
BILL JOY, SUN MICROSYSTEMS' chief scientist, is responsible for establishing a new order in the software world with Java technology. Java's success as a programming language, providing a bridge for disparate operating systems and network architectures, was more a surprise than a planned event. But it is no surprise that an industry movement with Java's impact was the brainchild of Bill Joy, one of the most celebrated leaders of the computing industry.

Joy seems to have gone full circle back to his Berkeley days. As primary designer of BSD Unix while in graduate studies at the University of California, Berkeley, Joy helped introduce technologies such as virtual memory and internetworking using TCP/IP.

The verdict is still out on Sun's Java-based networking technology, Jini, which was designed as an open-source core technology for networks or networked personal devices and appliances. But Joy's new brainchild, the MAJC chip (pronounced "magic" and standing for *Microprocessor Architecture for Java Computing*), is being promoted as "the most important semiconductor architecture of the next 20 years." Sun says the chip is particularly well suited to handling the enormous streams of visual and audio data we all expect to experience on the Internet.

This is something Joy obviously knows a lot about, since he was the codesigner of the SPARC microprocessor and is considered one of the people responsible for shaping the Internet as we know it today. In these accomplishments and more—which we admire and even envy—his intelligence and insight have been directed toward making technologies work to our advantage.

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Handspring Visor

AT FIRST GLANCE, the Handspring Visor appears to be a clone of Palm Computing's popular hand-helds, but a closer look reveals a new architecture for plug-in devices that really sets this model apart from Palm's personal organizers. The difference is the Springboard hardware on the back of the Visor, which allows for a wide range of expansion possibilities.

Concealed by a removable protection panel, the Springboard expansion slot resembles a CompactFlash card slot but is slightly larger. Expansion modules slide snugly into the slot, so no protective door is required. This plug-and-play slot lets you quickly add extras such as pagers, modems, MP3 players, Internet-access programs, and all types of applications and utilities to the basic Visor. Handspring's technology makes extending the Visor's capabilities impressively easy, because all the necessary software and hardware upgrades are embedded in a single Springboard expansion module. This approach represents a big departure from other PDAs, whose expansion and upgrade options are more limited and harder to install.

To push the technology into the mainstream market, Handspring is licensing the Springboard architecture to other computer manufacturers and encouraging third-party development of expansion modules. We've already seen unique applications, such as a fitness monitor to check your heartbeat and body temperature. And you can expect additional Visor products, such as cell phones, global positioning satellite receivers, voice recorders, digital cameras, smart card readers, and bar code scanners. What makes this technology unique is that the code to make the hardware device work is embedded in the slot; the driver installs in the operating system when you plug in a device and uninstalls when you unplug it.

With its built-in applications, five case-color choices, and compatibility with existing Palm applications, this PDA is poised to broaden the use of hand-held devices at work and at home. Springboard makes the Visor the most versatile hand-held we've ever seen. (Handspring Inc., Mountain View, CA; 888-565-9393, 650-566-8100; www.handspring.com.)



RIM BlackBerry

Research In Motion's handy RIM BlackBerry, a two-way wireless messaging device, extends Microsoft Exchange corporate e-mail using a packet radio network. This hand-held, which looks like an ordinary pager, lets you send and receive messages routed through your normal office e-mail account, while giving you the usual hand-held capabilities, such as keeping appointments and personal information at hand.

The BlackBerry is a pretty powerful little PDA, built with an Intel 386 processor, a wireless modem, 2MB of memory, and a miniature QWERTY keyboard. It also uses a docking cradle and integrated e-mail/organizer software that synchronizes with the desktop side of the BlackBerry's programs.

The real benefit of the BlackBerry is the way it keeps itself constantly updated with current messages. As messages arrive in your e-mail account, they're posted to the Bell South Intelligent Wireless Network in an encrypted form that only your personal hand-held can read. There's no dialing in to the corporate network to check your e-mail when you're traveling. The BlackBerry simply notifies you when you have an incoming message waiting to be read. (Research in Motion Ltd., Waterloo, Ontario, Canada; 877-255-2377; www.rim.com.)

[Finalists]

3Com Palm VII

The first mass-market "connect anywhere" PDA, the 3Com Palm VII uses a wireless modem and special applications with the capability to give you information on the run. The Palm VII's method of accessing Internet information is called *Web clipping*. Rather than browsing, you send information requests to content provider sites using the Palm paging network. The information provider's graphics, menus, and query forms are already stored on the Palm VII, so you don't have to download them each time you send a request.

Besides organizing your contacts, tasks, and appointments with a pocket-size PDA only slightly larger than a Palm III, you can now use the same device to send and receive e-mail and query Web sites for information. True, you can't use the Palm VII to cruise Web sites, download files from FTP sites, or converse in chat rooms. But you can exchange e-mail, complete e-commerce transactions, and interact with specific Internet sites to pull down information such as news, sports scores, stock prices, traffic reports, and weather updates.

Because it delivers only the information you really need wherever you are, the Palm VII provides a potent glimpse into the totally wired, constantly connected future. (Palm Computing Inc., a 3Com Company, Santa Clara, CA; 800-881-7256; www.palm.com.)

Hand in Hand Handspring, formerly known as JD Technologies, was formed by Palm Computing's original founders, Jeff Hawkins and Donna Dubinsky. The pair left 3Com in 1998. Armed with a

Palm operating-system license and venture capital from some Silicon Valley regulars, they soon released the first Handspring Visor to widespread positive reviews in 1999.



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technical excellence awards peripherals

IBM 340 MB microdrive

YOU HAVE TO SEE it to believe it. The IBM 340 MB microdrive—a \$500 removable hard disk for notebooks, Windows CE PDAs, and select digital cameras—is slightly larger than a matchbook. It may look like a typical CompactFlash card, but inside there's a single drive platter, about the size of a quarter and nearly as thin, that stores and transfers files as fast as any flash memory card.

Such miniaturization is impressive, but there's more. The microdrive provides a truly useful amount of extra storage capacity for a growing list of mobile business, entertainment, and photography devices. Plugged into a CF+ Type II slot or



connected to a PC Card adapter, the microdrive holds enough MP3 music, photographic images, or work-related files to keep you occupied for hours. And it has enough speed to be a useful addition even to laptops.

There seems to be no end to the story of expanding storage on shrinking media, either. IBM predicts that the next step up in this disk's capacity will take it to 600MB. With removable storage available at such a low cost per megabyte, microdrive technology should be an important component in business and consumer electronics for years to come. (IBM Corp., San Jose, CA; 888-426-5214; www.ibm.com.)

Compaq MP 1600 Microportable Projector

Here is a projector light and small enough to carry in a laptop bag—the kind of innovative business tool we love. At a little over 4 pounds, the Compaq MP 1600 Microportable Projector is suitable for professionals who need to give demonstrations, presentations, and slide shows wherever they go.

The MP 1600 uses Texas Instruments' DLP (Digital Light Processing) technology to project sharp, clear images at up to 30 feet. It's the first portable projector we've seen that sits upright rather than lying flat. Best of all are its brightness (600 ANSI lumens) and its support for high resolution (XGA). (Compaq Computer Corp., Houston; 800-888-0220; www.compaq.com.)

HP PhotoSmart P1100 and HP DeskJet 970Cse

With digital cameras becoming almost as common as PDAs, Hewlett-Packard builds the same great photo-printing technology into both its HP PhotoSmart P1100 and DeskJet 970Cse printers. The P1100 includes extra digital camera-ready features, with slots for CompactFlash and SmartMedia cards. Like the 970Cse, it provides a USB connection, but it uses its extra card slots as a quick way to get images from digital cameras. And the USB connection lets it serve as a CompactFlash or SmartMedia reader for a PC, too. Both units have duplex capabilities, so you can print and publish colorful pages for a variety of uses. (Hewlett-Packard Co., Palo Alto, CA; 800-752-0900; www.hp.com.)

The Maxidrive? Never resting on past achievements, such as the world's smallest hard disk, IBM announced the world's largest hard disk at the end of October. The 73.4GB IBM Ultrastar pushed aside the 37GB IBM Deskstar, which reigned for five months.

Athlon, Athlon At the Petition Petition Web site (www.petitionpetition.com), an appeal to Taiwanese motherboard manufacturers to support and use Advanced Micro Devices' newest microprocessor collected nearly 10,000 e-signatures in its first 14 days.

components

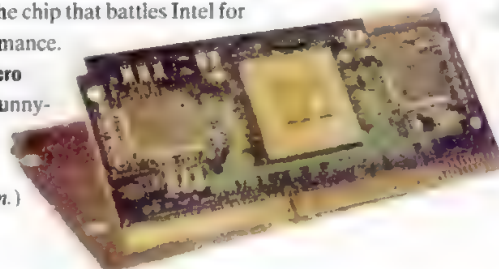
AMD Athlon

JUST WHEN WE THOUGHT Intel had a lock on the high end of the x86-compatible marketplace, in came AMD with its formidable AMD Athlon chip. A talented design team led by Dirk Meyer created this processor, based on an entirely new core. Like the Pentium II and III, the Athlon is mounted in a module with separate SRAM chips for the L2 cache, and it has a special bus that connects the processor to the L2 cache chips. As with Intel's current processors, the L2 cache has a size of 512K, and the interface runs at half of the processor's clock speed.

The Athlon's design has several advantages over the Pentium III. The Athlon has four times the L1 cache of the Pentium III, can execute more RISC-like internal instructions

per cycle, and can often decode more x86 instructions at a time. AMD's chip even beats the Pentium III in floating-point processing by a substantial margin. The Athlon uses a 200-MHz system bus, based on the Alpha 21264 bus, providing headroom for faster memory subsystems. Eventually, it may be used in everything from portables to multiprocessor units. For now, it's the chip that battles Intel for top PC performance.

(Advanced Micro Devices Inc., Sunnyvale, CA; 800-538-8450; www.amd.com.)



Motorola MPC7400 PowerPC

The Motorola MPC7400 PowerPC, dubbed the G4 by Apple, is the first commonly available microprocessor with a sustained performance of more than 1 gigaflop (a billion floating-point operations per second), according to Apple. Despite delays in the manufacture of the fastest version (500 MHz), our tests have shown that Motorola's latest PowerPC is a performance marvel.

The G4 contains an SIMD vector-processing engine called the AltiVec. Its integer and floating-point SIMD processing is ideal for processing 3-D graphics, digital audio and video, and other large streaming data sets. (Motorola Computer Group, Tempe, AZ; 800-759-1107; services.mcg.mot.com.)

nVidia GeForce 256

The nVidia GeForce 256 represents a new wave of 3-D graphics chips. In fact, nVidia prefers to call it a *graphics processing unit*, or GPU.

The GeForce 256, with 23 million transistors, is a significant advance—the first mainstream 3-D graphics chip to integrate discrete transform and lighting units on-chip. Such T&L capabilities mean that future game realism will be improved. With its 256-bit rendering engine, capable of processing 480 million trilinear-filtered pixels per second, and its support for a 128MB frame buffer, this chip is ready for the future. (nVidia Inc., Sunnyvale, CA; 408-615-2500; www.nvidia.com.)

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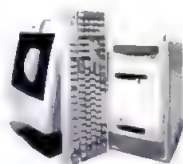
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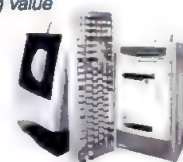
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Diamond Rio 500

TWENTY YEARS after Sony introduced the world to the "personal stereo" with its Walkman cassette player, palm-size MP3 players are some of the hottest toys around. This year, the Diamond Rio 500 really kicked the concept into the computer age.

The difference is the Rio 500's USB connection, plus storage that allows you to download over an hour's worth of music in a matter of minutes. It's the best way to tap into the vast library of MP3 audio files from the Web—the de facto standard for distributing compressed audio files. And new sites devoted to almost any style of music you can imagine are launching all over the Web. Even Diamond has spun off its Rio business into a new division with a full MP3 music site to support sales of the Rio 500.

The Rio 500's 64MB of built-in flash memory, soon to be expandable to 96MB, finally gives us an MP3 player with enough digital music storage to travel with. And the Smart-Media slot adds extra memory for storing 16MB to 32MB of additional tunes for longer trips. Best of all, you don't have to rely on downloads from the Web to put together your music selections. With easy-to-use software that "rips" MP3 files from your audio CDs, you can build your own music libraries and have them ready to roll.

The Rio 500 is a tough little player you can take anywhere. Since there are no moving parts, skipping is not a problem as it is with CD players, even during the most intense activities. And the unit's size lets you tuck it away anywhere. In the rapidly growing and very competitive MP3 player market, the Rio 500 is the best machine out there. (Diamond Multimedia Systems Inc., San Jose, CA; 800-468-5846; www.rioport.com.)



ReplayTV 2003 and TiVo PTV 100

ReplayTV and TiVo hardware are bringing the PC and home entertainment worlds closer. This is not total convergence of TV and computers, but it's getting a little closer, even though these products are single-purpose information appliances.

The ReplayTV 2003 and TiVo PTV 100 are more than digital video recorders, though. Of course, they can record 10 to 30 hours of TV on a large hard disk using MPEG-2 compression. But they can do much more than simply play back the recorded content. They let you fast-forward live television shows and schedule recordings easily; they automatically update channel listings, and they can create custom viewing profiles based on programming preferences.

The design of these systems shows an understanding of how to use computing power to make personalizing entertainment choices easier. And the fact that the content is stored means that you can watch it whenever you want, exactly the way you want to see it. Best of all, each device is a lot easier to set up and use than a VCR—and that's no joke. (Replay Networks Inc., Mountain View, CA; 800-266-1301; www.replaytv.com. TiVo Inc., Sunnyvale, CA; 877-367-8486; www.tivo.com.)

[Finalists]

SETI@home

On the surface, SETI@home seems like an exercise in ironic humor. "Can you believe it? Someone came up with the idea of turning the search for extraterrestrial intelligence into a screen saver."

In fact, SETI@home is the first popular application to turn the Internet into a gigantic distributed computing system. There is a screen saver you have to download and install on your computer. But it's really a small application that goes out on the Internet and grabs a chunk of data recorded by the Arecibo Observatory radio telescope whenever your system is idle. Your system becomes a shared resource for the analysis of the radio telescope data, looking for signs of extraterrestrial radio signals.

By harnessing all the free CPU cycles of a vast army of PCs, SETI@home achieves aggregate computing power beyond that of the largest super-computer. Over 1.1 million people have downloaded it, contributing a total of 89,000 CPU-years to the search. Join in the fun. (SETI@home; setiathome.ssl.berkeley.edu.)

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Free MP3 Despite MP3's undeniably cool appeal and the huge number of free MP3 files moving across the Internet, digital distribution of music for profit is a slow starter. Jupiter Communications forecasts

a market that accounts for only 6 percent of total online music sales by 2003. Online retail music sales—mostly CDs sold over the Web—are predicted to be a \$2.3 billion business by 2003.

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PBX meets the LAN

LAN-based PBXs combine the best features of traditional proprietary phone systems with easy computer telephony integration.

BY FRANK J. DERFLER, JR., AND LES FREED

ARE YOU A REALTOR, INSURANCE AGENT, OR OTHER SERVICE PROVIDER WHOSE BUSINESS depends on working extensively with lots of clients over the telephone? If your business views the telephone as a corporate tool, it can benefit from integrating the phone system with the data network.

A technology called *computer telephony integration* (CTI) provides ways to use your data network to control incoming and outgoing calls and to link call information with PC-based applications such as contact management and special line of business programs. Smaller standard PBX systems and key systems often don't have good CTI options.

Generally, a PBX takes a few telephone lines, called trunks, to the outside world and makes them available throughout an office. PBX systems can have scores of capabilities for call handling, accounting, and priority management. LAN PBX systems extend call control features to LAN-connected PCs and provide a way to link applications to telephone systems. LAN PBXs may be more expensive initial purchases than plain old telephone alternatives—perhaps several hundred dollars per seat more—but they offer unique features and flexibility, and they lay the groundwork for new applications and capabilities. Moves, adds, and changes are simpler and less costly than with traditional PBXs, and in most cases LAN PBXs can be managed by the staff that manages your data network.

For this story we tested the AltiGen AltiServ, Cisco CallManager, IBM Computer Telephony Business Solution (CTBS), Mitel SX-2000 PBX, Praxon Phone Data eXchange (PDX), Shoreline ShoreGear IPBX-12, Siemens HiNet RC 3000, and 3Com NBX 100 systems at PC Magazine Labs. Two other LAN PBX vendors, Merlot and Vertical Networks, were unable to provide products in time for testing. Lucent and Nortel are working on similar products but were also not ready in time. Artisoft's TeleVantage was between two versions during the testing, and the product is discussed in a sidebar (page 137).

These LAN PBX products are part of tomorrow's infrastructure. Their capabilities should carry you for a decade. Features such as voice mail are standard in most LAN PBX products. All except the Cisco CallManager offer on-screen call control. Call control functions let individuals answer, initiate, transfer, forward, park, and do other sophisticated telephone tasks from their computer screens with client software that the PBX packages provide. Some products, such as those from the old-line PBX vendors

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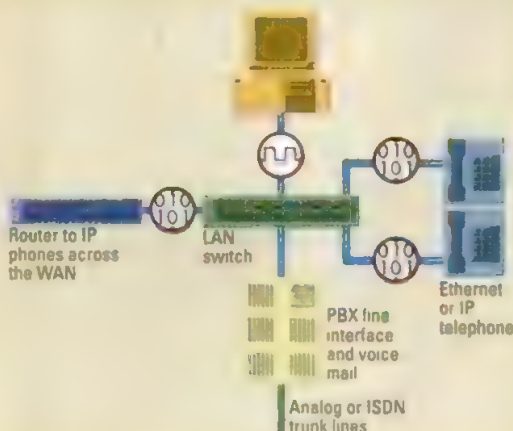
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LAN PBX Architectures

Traditional voice PBX systems use proprietary architectures, with call control and other computer telephony features offered as added-cost, proprietary packages. LAN PBXs come in a variety of architectures that tightly integrate with LANs. Some LAN PBXs use unique IP/Ethernet phones connected to LAN cable, and others use standard instruments and wiring for parts of the systems.

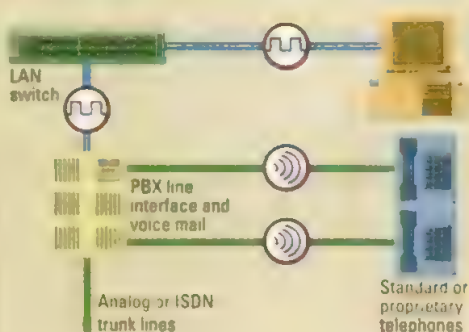
COMBINED VOICE AND DATA

With an Ethernet PBX from Cisco, Siemens, or 3Com, digitized voice and call control run over the same Ethernet LAN as your company's data. You get excellent scalability and call control; adds, moves, and changes are much easier than with a proprietary PBX. You must, however, purchase expensive IP or Ethernet telephones, and you'll have to design your network carefully. You'll still need traditional phone lines for fax machines.



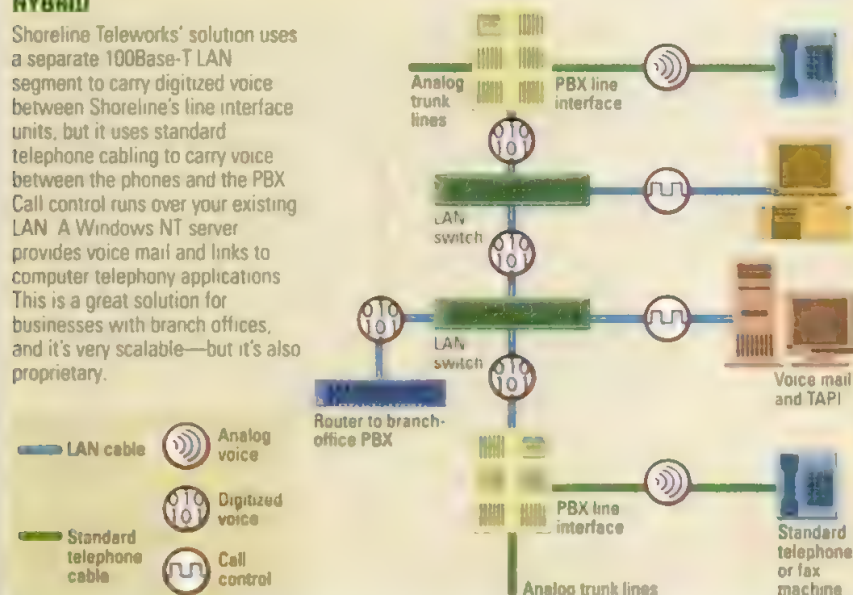
SEPARATE VOICE AND DATA

Products from Altigen, IBM, Mitel, and Praxon use the LAN for call control and use standard telephone cabling for voice calls. A central PBX houses line cards and voice mail and may also hold a router, an e-mail server, an FTP server, a file server, and other network devices. Though this solution keeps voice traffic off the LAN and works well with standard fax machines and phones, it requires a separate cabling system, and moves and changes are more complicated than with an Ethernet PBX.



HYBRID

Shoreline Teleworks' solution uses a separate 100Base-T LAN segment to carry digitized voice between Shoreline's line interface units, but it uses standard telephone cabling to carry voice between the phones and the PBX. Call control runs over your existing LAN. A Windows NT server provides voice mail and links to computer telephony applications. This is a great solution for businesses with branch offices, and it's very scalable—but it's also proprietary.



Siemens and Mitel, offer every arcane feature you could get from their traditional PBX products.

All provide the structure to integrate contact management programs and specialized business applications with the telephone system. You can create or add third-party applications that react when the phone rings or when you place a call by providing business information about the person on the other end of the line. All the systems we tested except for the SX-2000 PBX let you attach voice mail as WAV files to e-mail.

Are these features enough to justify throwing your old telephone system into the dumpster? From our testing at PC Magazine Labs, we conclude that LAN PBXs should be your first consideration when you open a new office or change locations, but they aren't compelling enough to force a change unless your business plan demands better integration between business applications and the telephone system.

CONFUSING CONFIGURATIONS

There are fundamental differences among the LAN PBXs we tested. They all use the LAN for call control, but only a few carry voice over the LAN. Our diagram ("LAN PBX Architectures") shows the three configurations we found and describes their pros and cons.

The Ethernet/IP phone systems from Cisco, Siemens, and 3Com use phones that are networked devices just like your PC or print server. Each phone instrument digitizes the voice, may or may not encapsulate it into IP, and sends it out over Ethernet on the standard corporate LAN. These products also let you use Voice over IP (VoIP) technology on wide area networks. Because these are network devices, your organization can have calling among offices in different locations at no added cost per minute. You can also add VoIP calling capabilities to a standard PBX using a device called a gateway (as discussed in "Goodbye, Phone Bill?", October 6, 1998, and "Talk Gets Cheaper," February 9, 1999), but these new Ethernet/IP phone systems provide desktop-to-desktop digital service across the LAN.

Arranging the additions, moves, and changes of employees is a time-consuming

ing job in a traditional telephone system, but doing so using the Windows-based interfaces these products provide is simple. The three Ethernet/IP phone systems give you the ability to carry your desk phone anywhere in a building, plug it into any LAN cable, and have your full telephone service and unique number.

There are two significant downside elements, however, to the Ethernet/IP phone products: unique phones and the need for a first-class network architecture. These IP phones are relatively expensive (from \$350 to about \$500 each). If the company disappears or drops the product, you could own orphan products. Also, these unique phones claim to eliminate the need for regular telephone wiring, but that isn't completely true, and it might not be desirable. People aren't going to give up their fax machines or even their dial-up modems easily. Except for the RC 3000, which offers an IP-to-phone device, your standard dial-up devices and commercial-grade desktop and conference phones will still need their own telephone cables and dedicated outside lines.

You'll also need to exercise care in designing your network architecture to account for the bandwidth needs of voice traffic. See the sidebar "Prepare Your LAN for Voice" for more information.

The Shoreline product is unique in that it moves voice packets across a LAN, typically dedicated, between Shoreline wire hubs, but the desktop devices are standard telephones. This is a flexible and innovative system. It is great for an organization with many small offices, such as bank branches, connected by a managed data network.

The remaining products use an approach that puts call control information on the LAN while sending the voice calls over standard telephone wiring. The Praxon Phone Data eXchange (PDX) is unique, because it also hosts a LAN firewall, mail server, and other network services but connects to the desktop phones over standard telephone cables. The PDX can be a valuable tool for both telephone and LAN ser-

- AltiGen Altiserv
- 3Com NBX 100



All of the LAN PBXs have pluses and minuses. The 3Com NBX 100 and the AltiGen Altiserv provide the most complete configurations and ease of use.

If you're looking to put voice, call control, and your company's data on the same network, then go with the 3Com NBX 100. It's the only solution that gives you everything you need to place and receive calls on your LAN. Voice quality is excellent, installation is easy, and the 3Com Ethernet phones are simple to use. The NBX 100 provides a complete set of call control and telephony features. And at \$13,582 for our 18-extension, 6-trunk line configuration, including Ethernet phones, the NBX 100 was the least expensive of the full LAN-based products. Keep in mind, however, that running voice over the LAN requires a fairly robust network architecture.

We also like the AltiGen Altiserv, which puts call control over the LAN

but uses standard analog telephones and cabling. Altiserv is one of the least expensive products in the roundup, yet it does provide a very complete package with excellent call handling and client software.

Two products deserve honorable mention. The Praxon Phone Data eXchange provides a complete phone and data network solution for the small office; it includes e-mail, firewall, FTP, remote access, and a 10Base-T hub, all for a bargain price. It offers decent call control and telephony features, excellent e-mail integration, and easy installation.

Shoreline's ShoreGear IPBX-12 has a unique architecture that runs voice over a dedicated LAN between phone switches but uses standard analog phones. It's a great choice for companies with multiple branch offices.

vices, particularly in a new office where it meets the need for telephone as well as Internet and intranet LAN functions.

Reliability is an obvious concern when you're thinking of putting a PBX on traditionally unreliable data networks. These products vary in fail-over and redundancy features. The IBM, Mitel, and Shoreline products have the strongest reliability features, continuing to allow calls even when the server is down.

SIZE AND COST

Most of the products we examined are aimed at branch offices and small to medium-size businesses. They are practical for offices with as few as four to five heavy

telephone users and gracefully expand to 100 or more lines. If it's important to be able to grow beyond that level, the LAN PBX products from the traditional PBX vendors, such as Mitel and Siemens, offer the best options.

If you're opening a new office or installing a new phone system, one of these LAN PBXs should suit you for years to come.

AltiGen Altiserv

18-extension, 6-trunk configuration, \$1,100 street. AltiGen Communications Inc., Fremont, CA; 888-258-4436, 510-252-9712; www.altigen.com.



The AltiGen Altiserv is the graybeard of our product roundup, having been on the market for more than three years. AltiGen's experience shows in dozens of small details that make the product

Our Contributors: STEVE RIGNEY and LES FREED are contributing editors of *PC Magazine*. FRANK J. DERFLER, JR., is senior networking editor. Executive editor LEON ERLANGER and PC Magazine Labs project leader RUSS IWANCHUK were in charge of this story.

a pleasure to use. At around \$610 per extension (plus the cost of phones) in our configuration, the AltiServ is inexpensive, but it offers a complete feature set—smooth voice/e-mail integration and simple setup and administration. Of the products that separate voice and data, the AltiServ is your best option; we have selected it as an Editors' Choice in this roundup.

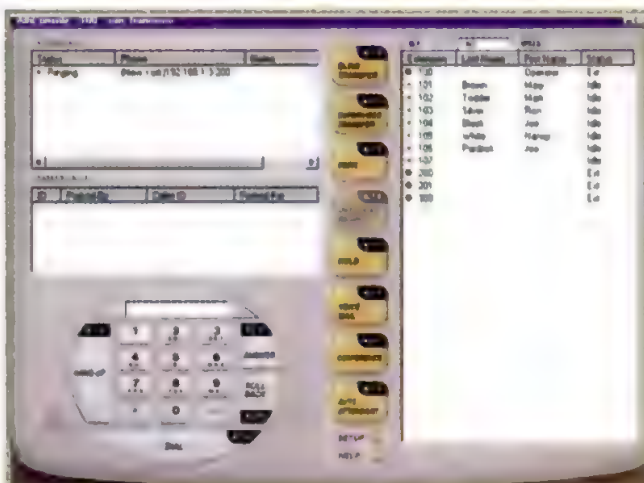
The AltiServ system consists of a Windows NT Server PC, one or more AltiGen Quantum telephony boards, AltiGen's AltiWare server software (\$695 list), and AltiView client software. AltiGen manufactures several Quantum interface cards with different combinations of trunk and extension interfaces, as well as T1 and ISDN PRI interfaces. The AltiGen system works with any standard telephone, but you'll need to factor the cost of phones into your buying decision. A single AltiServ server can support up to 256 ports, with up to 160 extension and 96 trunk lines. Several AltiServ servers can be used together on a LAN or connected via a WAN. AltiGen's optional VoIP support (\$1,995 per server) allows two AltiGen PBX systems to communicate over the Internet or a private IP network.

Typically, a VAR installs the AltiGen Quantum boards and AltiWare server software in the server PC and performs the initial installation and configuration at the customer site. After the sale, most AltiGen customers handle their own administration, calling the VAR when they need additional capacity. AltiGen's Microsoft Windows-based management software is intuitive and easy to use, but it operates only from PCs attached to the local LAN. Moves and extension changes are usually the most time-consuming PBX administration chores, but AltiGen users can move their phones simply by plugging

them into any available jacks and dialing their four-digit codes followed by their extension numbers.

AltiView, AltiGen's standard user client software, employs a futuristic but attractive user interface to manage incoming and outgoing calls and voice mail. A monitoring feature lets authorized users view the status of any other extension or group of extensions. A client-based call log keeps track of incoming and outgoing calls, with caller ID, date and time, and call duration, making the system ideal for law firms, consultants, and other professionals who bill clients for their time.

AltiGen's call handling and voice mail are superb and include innovative features we haven't seen in other products. A One Number Access feature lets users tell the AltiServ system where to find them when they are out of the office. When a call comes in to a user's phone, the AltiGen system answers and asks the caller to say his or her name. The system puts the caller on hold and dials up to four numbers to track down the user. When the user answers from one of the remote numbers, the AltiGen system announces the caller's name (in the caller's own voice) and lets the user decide whether to take the call. Another clever feature, called Zoomerang, uses the caller ID data stored with each incoming voice mail message to let users return calls directly from the voice mail



AltiGen's AltiConsole shows the status of every phone in the system. The window on the upper left displays new incoming calls; the middle left window shows calls that are parked and waiting for an extension to answer. The row of big yellow buttons in the center provides access to frequently used functions.

PREPARE YOUR LAN FOR VOICE

The Cisco, Siemens, and 3Com products send digitized voice over the same LAN as your data. If voice packets are dropped or delayed, human conversation sounds like gargling. The best way to prevent this is to monitor your network. If you find utilization over 20 percent, try the following:

Add bandwidth. Move up to Fast Ethernet.

Use switches instead of hubs. This is a good idea in any case, and it's increasingly affordable.

Restrict broadcasts. Watch for IP multicast, audio, or video streams and even terminal servers. Heavy data streams can delay voice packets and garble voice quality.

Watch for big downloads. Restrict or restructure to avoid big downloads that can cause delays.

system through the PBX. When a returned call is complete, Zoomerang plays the next voice mail message, without making the user hang up and log on to the voice mail system again.

Most organizations will use AltiServ's 16 automatic attendants to handle incoming calls, but AltiGen offers an expanded client software package, called AltiConsole (\$495), for groups that prefer a traditional, human attendant-based system. —Les Freed

Cisco CallManager

18-extension, 6-trunk configuration, \$29,890 street. Cisco Systems Inc., San Jose, CA, 800-553-6387, 408-526-4000, www.cisco.com.

● Cisco takes an open-standards approach to voice and data convergence. The Cisco CallManager consists of standalone IP phones and call control software running on Windows NT. The user must purchase third-party hardware for trunk lines and gateways. The CallManager also lacks a software-based client and some important call control features such as restricting user calls based on numbers or time of day. And at \$1,660 per extension for our configuration, it's the most expensive



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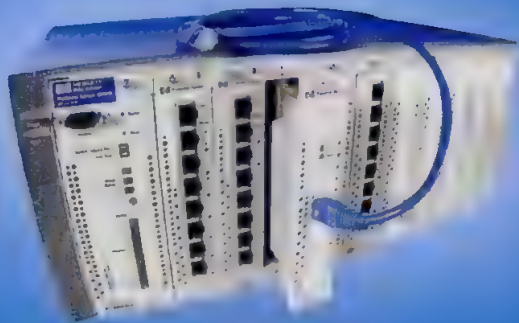
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72-port configuration list prices



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product in this roundup. The real appeal of the Cisco solution will undoubtedly come as more businesses move to IP phones and open standards such as H.323.

As with the 3Com NBX 100, the Cisco product uses quality of service settings to ensure voice quality on a busy LAN. Unlike the NBX phones, the Cisco IP phones are NetMeeting enabled. This means that you can perform NetMeeting tasks, such as video conferencing and application sharing, simply by hitting a button on your Cisco phone. The phones are available in 12- and 30-feature button versions for \$550 and \$650 (list), respectively. Because the system will work with almost any trunk line gateway, it is fairly scalable; you can populate a single LAN with several hundred IP phones. As with

the 3Com NBX phones, the Cisco IP phones provide dual 10-Mbps Ethernet ports that can take a phone and a client PC to the same wall jack.

The CallManager costs \$14,995 list and is sold separately from the IP phones. The software runs on Windows NT and requires Microsoft Internet Information Server to access the menu via a standard browser. We found it easy to install the IP phones and set up the users. Each phone includes a DHCP client

that can automatically lease an IP address. On the administrator side, all we had to do was provide a range of IP addresses for the phones. We found it easy to assign a phone number and a user name to each phone. The bundled voice mail system was also easy to set up, and the user can perform several tasks using the handset, including recording a message and setting up the voice mailbox.

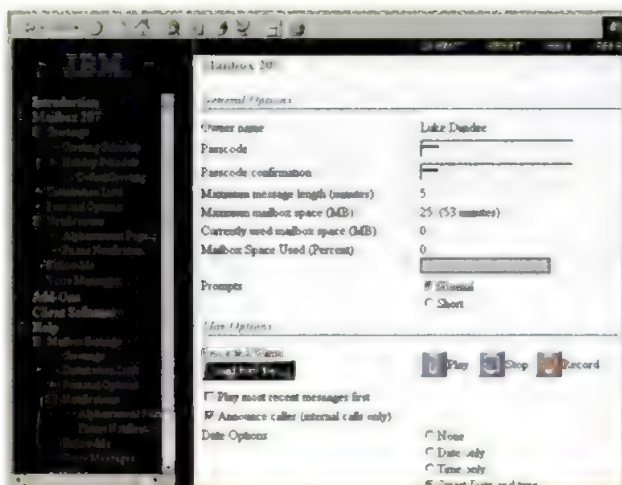
As do all of the products we reviewed except the Mitel system, the CallManager lets you forward any voice mail you receive to an SMTP e-mail address. The message is recorded and saved as a WAV file, which the e-mail recipient can open and listen to.

The administration utility is fairly straightforward, mainly because the product lacks detailed user control settings. The CallManager software will integrate with any LDAP-compliant database, so you can import user information into your phone directory.—*Steve Rigney*

IBM Computer Telephony Business Solution

18-extension, 6-trunk configuration, \$14,500 street. IBM Personal Systems Group, Research Triangle Park, NC; 888-426-5800; www.ibm.com.

● When we last reviewed the IBM Computer Telephony Business Solution (CTBS), we felt its feature set did not justify its price. Version 2.51 beefs up the feature set and adds support for the new IBM PCI telephony card. The CTBS's most attractive feature is the system's open application



IBM's client administration screen lets users set a large number of options—including greeting messages, voice mail options, and forwarding features—from any Web browser.

programming interface (API), which allows users or third-party software vendors to develop custom telephony applications for the CTBS platform. Like the AltiGen, Mitel, Praxon, and Shoreline products, the CTBS runs voice over its own cabling system, and it can use any analog phone.

The CTBS combines an IBM Netfinity server, one or more PCI and ISA telephony cards, and call control software from Coresoft Technologies into a full-featured, easy-to-use PBX system. The PCI card (\$7,000 street) supports 8 lines and 16 extensions, and the \$5,200 PBX-1ISA card connects 6 lines and 18 telephones. You can mix and match ISA and PCI cards in the server; the system can accommodate 96 extensions. Unlike many of the other products we tested, there are no software charges or license fees when you add users.

Installation and initial configuration are simple, although these are normally provided by a VAR. Once the system is installed, users can perform their own system management using IBM's new browser-based administration tool. The administration interface lets users modify their own voice mail settings, relieving some of the burden from the system administrator. Hardware additions must be performed by the VAR using a separate, password-protected hardware configuration program.

Call switching is performed on-board by the cards, so the system will continue to operate if Windows NT or the server application crashes.



www.pcmag.com/hotlinks

PC Magazine Online is the first place to look for reviews of telephony and Internet connectivity products for your business. For more information on computer telephony technology and LAN-based phone systems, visit these other sites.

>The CT Portal

www.computertelephony.org

This is a great jump-off site to dozens of other computer telephony pages, including a bookstore, vendor links, discussion forums, and analysis.

>Hello Direct.com

www.hello-direct.com

This is a good source for information and reviews on communications products. This site also contains a world of telephone toys—including PBX and key systems.

>CT Server

<http://ctserver.dialogic.com/ctserver/index.htm>

This is an excellent site describing Dialogic's concept of telephony servers.

>Ultraphones.com

www.ultraphones.com

This telecom "boutique" site features different phone instruments, including detailed descriptions and comparisons of products.

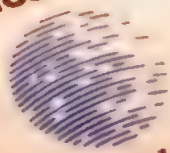
>Ablecomm Learn

www.ablecomm.com/learnng.htm

This indispensable site contains a glossary of PBX terms, PBX information, and many tips for buying and installing PBX systems.

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For deployment, we evaluate the product's architecture and ease of installation and configuration, from trunk lines to user end stations.

Most products scored well, but we especially liked the Praxon Phone Data eXchange's use of an analog handset to assign an IP address to the server. Other products required a terminal session. The administration rating reflects the ease and power with which administrators can implement user and extension adds, moves, and drops and configure features

such as ACD and auto-attendant. It also covers reporting and alert features. We give higher ratings to products with HTML interfaces and configuration via handsets. Client telephony includes telephony features, such as ACD, auto-attendant, call handling, voice mail, client desktop software, and network phones, where appropriate. For high availability, we rate how well each product's architecture can withstand server crashes and power outages, by using redundancy and fail-over. We gave high ratings to the IBM, Mitel, and Shoreline products, because they continue to provide dial tone and calling functionality when the server is down.

	Deployment	Administration	Client telephony	High availability
EDITORS' CHOICE Altigen Altiserv	Good	Excellent	Excellent	Fair
Cisco CallManager	Good	Good	Fair	Fair
IBM Computer Telephony Business Solution	Good	Good	Good	Good
Mitel SX-2000 PBX	Good	Fair	Good	Excellent
Praxon Phone Data eXchange	Excellent	Excellent	Good	Fair
Shoreline ShoreGear IPBX-12	Excellent	Excellent	Good	Excellent
Siemens HiNet RC 3000	Fair	Fair	Good	Fair
EDITORS' CHOICE 3Com NBX 100	Excellent	Excellent	Good	Good

IBM's Windows-based Call Manager client provides button-bar access to call management and voice mail features. We liked the easy-to-use workgroup status display, which lets you see the name, extension number, and status of other phones in your workgroup. A new call queuing feature allows users to create special call-waiting queues to let on-hold callers know how long it will be before their calls are answered. Callers always have the option of exiting to voice mail or switching their calls to an automated attendant at any time.

One of the major improvements over the product's previous release is the addition of an auto-respond feature, similar to Altiserv's Zoomerang, which lets users retrieving voice mail from off-premises reply to voice mail calls by dialing out through the PBX, saving both time and toll charges.

Call Manager provides excellent contact and voice mail integration with ACT, Goldmine, and Microsoft Outlook. IBM and its software partner, Coresoft, have created a variety of add-on applications that let users tailor the CTBS system to their needs. Users can also develop their own add-ons in C++ or Visual Basic, using the CoreSoftware development kit. Off-

the-shelf add-on applications include a fax server, alphanumeric paging, automatic call distribution, and Web-based voice mail retrieval.—LF

Mitel SX-2000 PBX

18-extension, 6-trunk configuration, \$27,000 street. Mitel Corp. (subsidiary of British Telecommunications PLC), Kanata, Ontario, Canada; 800-648-3579, 613-592-2122; www.mitel.com.

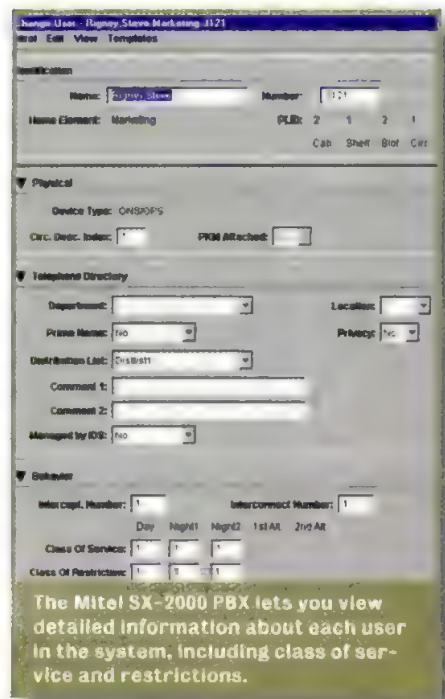
● At \$27,000 for our configuration, the Mitel SX-2000 PBX is the second most expensive system in this roundup (the CallManager is first), but its list of more than 1,000 telephony features can hold its own with just about any proprietary PBX on the market. One missing feature, offered by every other product we tested, is the ability to attach voice mail files to e-mail as WAV files. Mitel expects to include this feature in its next release. Some of us also found the monochrome LCD panels on the included phones difficult to read. The SX-2000 does not run voice over the data network, but its phones are proprietary. This solution is most appropriate for small and medium-size businesses with 30 employees and up that are looking for a powerful, scalable system.

The SX-2000 comes with control soft-

ware running on a Windows NT server, proprietary Mitel phones, and a separate proprietary chassis, called the peripheral node, to hold the trunk lines and phone ports. You can use a standard browser to configure the chassis settings; we found the Java interface a little slow, however, and the sheer number of features makes administration of the SX-2000 somewhat complex.

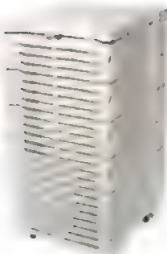
The Windows NT-based call control software runs connections to the LAN and uses a fiber-optic adapter to connect to the peripheral node. About the size of a small refrigerator, the peripheral node is where you connect your incoming trunk cards and ports for your internal Mitel phones. The peripheral node can handle any kind of incoming trunk line, including analog, PRI, and T1. The Windows NT server is provided by your Mitel VAR and is available in a fault-tolerant model, including a RAID level 5 subsystem and redundant power supplies. The SX-2000 is available only through VARs, and the price includes installation. After watching the Mitel technician install the system, we were glad he was around to help us.

It's impossible to cover all of the features of the SX-2000 here. One of the more interesting features is check-in, which lets a business such as a hotel automatically turn on a class of service to a phone when the guest arrives. We also liked the phone



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book editor that stores all the users, extensions, and call features in an Oracle database running on the Windows NT server. The server can communicate with Exchange, NDS, and any LDAP directory to integrate your phone users with your network users. The only major feature that is not bundled with the base product is voice mail, which you have to order and run separately from the SX-2000.

We saw a lot of intriguing phones while working on this story; the Mitel phones were among our favorites, though some of us found the screens a little dim. In addition to providing information, such as the name of the caller and caller ID on the LCD screens, the phones let you look up

extensions. You can, for example, use the keypad to type in the first few letters of a user's name, and the touch screen look-up button will find the phone number. Mitel also offers phones with backlit LCDs that are likely to be easier to read than those on the phones we received.—SR

Praxon Phone Data eXchange

18-extension, 8-trunk configuration, \$8,500 list. Praxon Inc., Campbell, CA; 888-871-9887, 408-871-1600; www.praxon.com.

● If you're looking for a total small-business solution, the Praxon Phone Data eXchange (PDX) is your best bet. Besides being a phone system with integrated voice mail, the PDX is the only product

we tested that includes remote access, e-mail, FTP, firewall, DHCP, and NAT servers; a full blown LAN to LAN router; and even a 10Base-T hub. The product's use of standard PSTN phones makes it easy and inexpensive to deploy, and useful call features such as direct inward dial (which gives each individual phone its own seven-digit number) rival those found in the more traditional PBX products, such as the Mitel SX-2000. The best part is that the package, minus standard phones, came to \$472 per extension in our configuration. About the only major features missing from the PDX are detailed classes of service and restriction settings.

The phone features are housed in a

ARTISOFT'S TELEVANTAGE

Artisoft was between two versions of its TeleVantage product when we were testing for this roundup. TeleVantage illustrates how a developer can use open standards to build a computer telephony solution. TeleVantage uses Dialogic hardware and Artisoft-developed application software to deliver a system that is cost- and feature-competitive with many of the off-the-shelf products in our main story. As with the systems from Altigen, Mitel, and Praxon, TeleVantage runs voice over a dedicated network, though Version 3.0 will have some combined voice and data features.

TeleVantage 2.1 runs on a Windows NT server PC and supports up to 144 phones and 48 lines using standard analog telephone sets. Artisoft sells the Interactive Voice Response (IVR) Starter Kit separately, which includes Dialogic hardware and Artisoft software that supports up to 96 ports, making it a good choice for small companies. A typical TeleVantage system costs between \$400 and \$500 per user, including the hardware, software, and server PC.

TeleVantage is easy to install and configure. Its features include voice mail and call forwarding. The TeleVantage client software runs on Windows 95, 98, or Windows NT and provides users with an attractive, easy-to-understand interface for access to call handling, voice mail, and call logging features.

TeleVantage lets client users set up special greetings and call handling for specific callers. For example, a user can program distinctive ring patterns and customized voice mail greetings for important clients ("Hello, Mr. Jones; please hold on for just a few

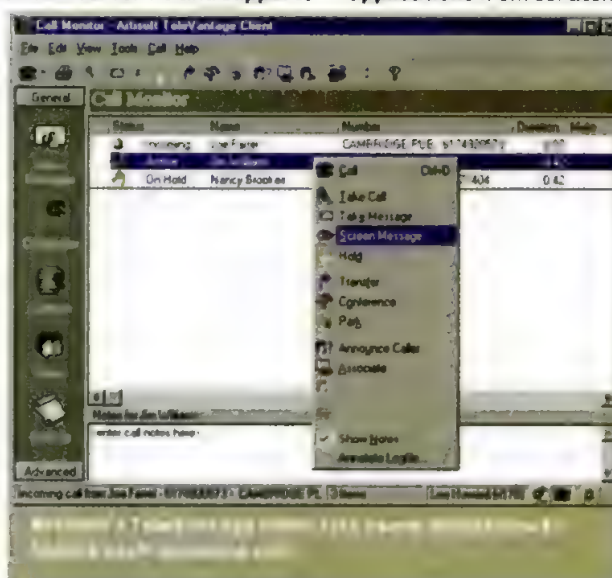
seconds while I blow off this less important call"). TeleVantage's personal phone book feature lets users add notes to each entry in their phone books (such as clients' children's names, important dates, details of the previous phone call, and so on). TeleVantage uses caller ID to fetch and display the information for incoming calls.

VARs and software developers can customize TeleVantage using Artisoft's Visual Voice Pro, an open-architecture tool kit that adds telephony capabilities to Microsoft Visual Basic, Visual C++, Visual J++, and Inprise's Delphi. Developers can build applications from scratch, or they can save time by using the

sample applications included with Visual Voice Pro as a starting point for custom applications. The tools in Visual Voice Pro provide programmers with access to voice response and voice messaging, caller ID, touch-tone decoding, and call control features (including dial, transfer, and conference commands), as well as a fax gateway.

Version 3.0 was being prepared for launch as we went to press and is due to ship in January 2000. The new version increases the maximum size of a TeleVantage system to 96 trunks and 264 extensions. A new IP telephony interface will allow two TeleVantage systems to

route calls over the Internet or a private IP network. The IP telephony interface includes a Web-based call center, which lets customers with sound-equipped PCs click a button on a Web site and be connected to a call center on the TeleVantage system. Other planned enhancements include a new browser-based client interface and enhanced log analysis. (Artisoft Inc.; 800-914-9985, 617-354-0600; www.artisoft.com.)





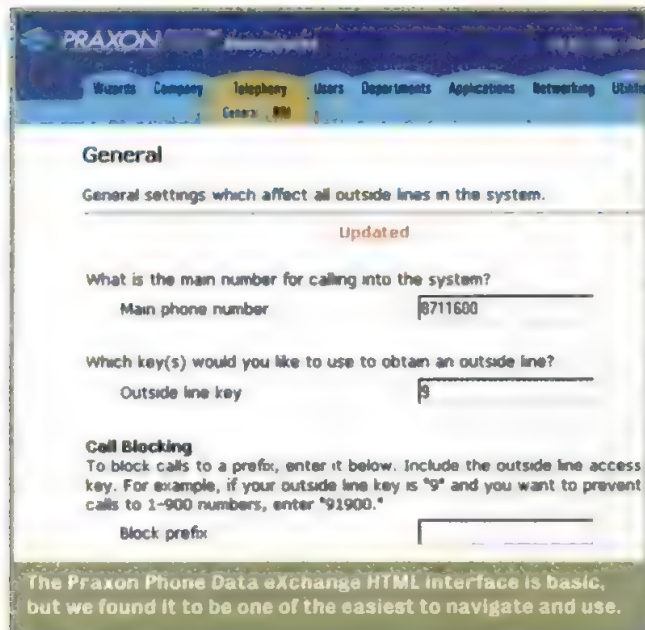
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chassis about the size of three unabridged dictionaries. The unit is not rack-mountable, so you'll have to find a shelf in your wiring closet. The chassis offers four slots for the phone and Ethernet connections. One of the slots is always reserved for the controller adapter that runs the VxWorks operating system. You can populate the other slots with an 8-port BRI, a T1, and 16- or 32-port phone adapters. Praxon doesn't offer a PRI adapter for the PDX. Like the AltiGen, IBM, and Shoreline products, the PDX uses standard POTS phones, which keeps the cost down, and includes an HTML GUI for dialing and using calling features directly from your desktop PC.



The PDX is one of the easiest products to install. All we had to do to assign it an IP address was attach a PSTN phone to the unit and use DTMF (dial tones) to configure the address. All of the other products we tested require you to connect a terminal for initial setup. After we had assigned the IP address, we were able to use a browser to assign phone numbers to users, set up voice mail, and perform other tasks. The interface displays a series of steps that you must perform in a specific order. The PDX was the only product we were able to configure completely without consulting the manual or working with a technician.

The PDX doesn't offer all of the call restriction and call handling features of products such as the Mitel SX-2000, but it

offers excellent integration with e-mail. You can configure the product to automatically send e-mail to a user whenever he receives a voice mail. Like most of the other products, the voice mail can be saved as a WAV file and played back by the user. The PDX puts the caller's name in the address book, so you know who the voice mail is from.—SR

Shoreline ShoreGear IPBX-12

18-extension, 6-trunk configuration, \$11,530 list. Shoreline Teleworks Inc., Sunnyvale, CA; 800-425-9385, 408-331-3300; www.shoretel.com.

● At about \$640 per user in our configuration (not including the price of handsets), the Shoreline ShoreGear IPBX-12 has a relatively high price tag, but in return you get easy expandability and the ability to manage multiple distributed IPBX-12 switches from a single interface. The IPBX-12's unique architecture, which uses standard analog phones but routes calls from switch to switch over a dedicated IP connection, is an excellent solution for companies with more than one location.

A basic IPBX-12 system consists of one or more IPBX-12 Voice Switch units (\$2,695 list for 12 ports, plus per-user license fees), a Windows NT 4.0 Server running Shoreline's ShoreWare Server (\$1,695 for up to 100 users, \$5,495 for more than 100 users and multisite usage), and a network of client PCs running Shoreline's Desktop Client software. The IPBX-12 units communicate with each other and with the ShoreWare Server via a 100BaseT Ethernet connection. Voice calls routed between two IPBX-12 units travel as IP packets. System management is performed via an attractive browser-based interface.

As with the AltiGen and Praxon products, the IPBX-12 system uses standard analog telephone sets (with name and number caller ID). The ShoreWare server manages the system, handles voice

mail, and provides interfaces for COM and TAPI interfaces. The call switching is handled by the IPBX-12 units, so calls can continue even if the server crashes.

Each of the IPBX-12's front panel jacks connects to a voice port, which in turn can connect to either a phone line or a telephone set. The IPBX-12 is the only system that also has a single RJ-21x jack to connect the IPBX-12 to a standard punch-down block. This allows easy replacement of an existing PBX system.

We liked the system's easy expandability. If you run out of ports, you simply add an IPBX-12 unit and connect it to the LAN. You can add switches—up to 30 total, for a maximum of 360 ports—without taking the system down.

Because the Shoreline system uses IP for interswitch communications, you can install multiple switches in several locations and have them operate as a single, unified system. A unified dialing plan lets users dial extensions at a remote IPBX-12 as if they were local, and users on any switch can place outgoing local calls using the trunk lines from any other switch.

The IPBX-12's telephony features are on a par with the other systems in our review group. The Shoreline Desktop Client software provides call control, custom call handling, and voice mail management from a single user interface. It also provides call history, personal and systemwide dialing directory, and message notification displays. Shoreline Administrator (\$395) is designed for switchboard operators, executive administrators, and departmental receptionists. It allows the user to manage incoming calls for a large group of users. Shoreline Workgroup (\$295) adds Automatic Call Distribution and Call Center functionality, group mailboxes, group monitoring, and agent log-on/log-out features.—LF

Siemens HiNet RC 3000

18-extension, 6-trunk configuration, \$18,000 street. Siemens Information and Communication Networks Inc., Santa Clara, CA; 800-765-6123, 561-959-5381; www.siemens.com.

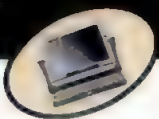
● Of the three products that send voice and data over the LAN, the Siemens HiNet RC 3000 is the one most geared towards the enterprise. Unfortunately, we found the included Ethernet phones difficult to use and were surprised by the gate-

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LAN PBXs

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	AltGen AltIServ	Cisco CallManager	IBM Computer Telephony Business Solution	Mitel SX-2000 PBX	Praxon Phone Data eXchange	Shoreline ShoreGear IPBX-12	Siemens HiNet RC 3000	3Com NBX 100
Price for full configuration with 18 extensions and 6 trunk lines	\$11,600 street	\$1,600 list	\$14,600 street	\$27,000 street	\$15,000 list	\$11,430 list	\$18,000 street	\$13,582 list
Price includes 18 handsets	☐	☒	☒	☒	☐	☐	☒	☒
INFRASTRUCTURE AND CAPACITY								
Wiring to desk	Category 3, Category 5	Category 3, Category 5	Category 3	Category 3	Category 3, Category 5	Category 3, Category 5	Category 3, Category 5	Category 3, Category 5
Telephony server operating system	Windows NT Server	Windows NT Server	Windows NT Server	Windows NT Server	VxWorks	Windows NT Server	Windows NT Server	VxWorks
Type of phones that can be used	Analog	Analog, Digital, IP	Analog	Analog, Digital	Analog, Digital	Analog	Analog, IP	Ethernet
Maximum number of ports/extensions/trunk lines	256 / 160 / 96	Unlimited	144 / 96 / 48	192 / 120 / 96	64 / 64 / 24	360*	200 / 200 / 32	148 / 124 / 100
Trunk interface type	PSTN, PRI, T1	PSTN, BRI, PRI, T1	PSTN	PRI, T1/E1	PSTN, BRI, T1	PSTN, T1	BRI	PSTN
Call control and messaging APIs	Native API, TAPI	JTAPI, TAPI	MAPI, TAPI, TSAPI	TAPI, TSAPI	TAPI	TAPI	JTAPI	MAPI, TAPI
CALL FEATURES								
Automated attendant/call distribution	☒	☒	☒	☒	☒	☒	☐	☐
Number of simultaneous conference calls	32	99	8	8	64	120	N/A	60
Maximum participants per session	6	99	8	5	16	3	N/A	4
Caller ID	☒	☒	☒	☐	☒	☒	☒	☒
Message notification								
Phone light/Distinctive dial tone/Screen pops	☒	☒	☒	☒	☒	☒	☐	☐
Internal/External call forwarding	☒	☒	☒	☒	☒	☒	☒	☒
Call restrictions								
Long distance/International/Toll calls	☒	☒	☒	☒	☒	☒	☒	☒
Direct inward dial/paging	☒	☐	☐	☒	☒	☒	☐	☐
E-mail message integration	☒	☒	☒	☐	☒	☒	☒	☒
Dial by name from phone/from desktop	☒	☐	☒	☐	☒	☒	☒	☐
Internal/external call transfer	☒	☒	☒	☒	☒	☒	☒	☒
Do not disturb/Voice mail/Call park	☒	☐	☒	☐	☒	☒	☒	☒
Follow-me forwarding	☒	☐	☒	☒	☒	☒	☒	☐
MANAGEMENT AND ADMINISTRATION								
Programmable feature buttons	☒	☒	☒	☒	☐	☒	☐	☒
Web-based management console	☒	☒	☒	☒	☒	☒	☒	☒
Desktop client application	☒	☐	☒	☒	☒	☒	☒	☒
Movable extensions	☒	☒	☒	☒	☒	☒	☒	☒
Individual/group profiles	☒	☐	☐	☒	☒	☒	☒	☒
Contact database import	☒	☐	☒	☒	☒	☒	☒	☐
Built-in/custom reporting	☒	☐	☒	☒	☒	☒	☐	☐
Real-time status monitor	☒	☒	☒	☒	☒	☒	☐	☐
Time-of-day policy management	☒	☒	☒	☒	☒	☒	☐	☒
Hot-pluggable hardware/RAID support	☒	☒	☒	☒	☐	☒	☐	☐
Automated backup/client log-on	☒	☐	☒	☒	☒	☒	☐	☐
E-mail server SMTP / POP3 / IMAP4	☒	☒	☐	☐	☒	☐	☐	☐

* The maximum number of extensions and trunks can be any combination that adds up to 360 ports.

N/A—not applicable. The product does not have this feature.

way Siemens sent, which offered only four trunk lines—fewer than the other products we tested. Similar to the Cisco model, the RC 3000 family consists of a call server running on Windows NT and separate IP phones. The Siemens product, however, includes a software-based phone that works with a handset to let you dial from your PC.

The RC 3000 doesn't offer a connection to the PSTN. You'll have to purchase

a third-party gateway, such as the RadVision ISDN-to-Ethernet solution that Siemens sent us. The model we tested provided only four BRI ports for a total of eight incoming and outgoing calls. Unlike the 3Com NBX 100, the RC 3000 call-server and IP phones, called LP 5100s, don't provide any quality of service features to give you toll quality on a busy LAN. Fortunately, we found the sound to be clear and static free on our tests.

The RC 3000 server software retails for \$4,250, and each IP or software-based phone you buy is \$400. If you want to connect a PSTN device, such as a fax machine or standard phone to the RC 3000, you'll have to buy a terminal adapter to convert the digital ISDN signals to analog. The system is normally sold through VARs; the reseller usually includes the PC running Windows NT, or you can purchase a system from Siemens. Administration is

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PBX GLOSSARY

ACD (automatic call distribution) A feature that intelligently distributes incoming calls among a specific group of employees.

Automated attendant A software module that lets you create voice menus to handle incoming calls.

BRI (basic rate interface) A type of ISDN line consisting of two B-channels (bearer channels), each of which carries simultaneous voice and data service at 64 Kbps, and one D-channel (data channel) that carries call information at 16 Kbps. ISDN lines are frequently used for PBX trunk lines.

Call control Functions that let individuals answer, initiate, transfer, forward, park, and perform other sophisticated telephone tasks from their computer screens with client software provided by PBX packages.

DiD (direct inward dial) A PBX feature that lets you dial directly to an extension from the outside, instead of to an attendant.

Extensions Virtual phone numbers assigned to a PBX's internal lines.

Follow-me forwarding A feature that routes a call to an alternate extension or outside phone number when a user so specifies.

IVR (interactive voice response) A type of system that adds database functionality to an automated attendant. IVRs allow you to create sophisticated applications that can, for example, report bank balances or look up credit card transactions.

PBX (private branch exchange) An in-house phone system that uses switching to share a small bank of trunk lines among a larger number of extensions.

Port A physical PBX interface that can be connected to either a trunk line or a phone extension.

POTS Plain old telephone service.

PRI (primary rate interface) A type of ISDN line consisting of 23 B-channels, each operating at 64 Kbps, and two 64-Kbps D-channels. Like BRIs and T1s, PRIs often serve as PBX trunk lines.

PSTN (public switched telephone network) An ordinary public telephone system.

T1 line A high-speed, 1.5-Mbps phone line that carries 24 analog phone calls simultaneously. T1s can serve as trunk lines for PBXs.

Trunk lines External phone lines leased from your local phone company.

VoIP (Voice over IP) A technology that runs digitized voice over an Internet Protocol network.

fairly easy, and all of the moves and changes are performed using any Java-compliant browser.

Like the 3Com IP phone, the LP 1500 features an analog display, but that is where the similarities end. The LP 1500's unique interface uses arrow keys to scroll through all of the options. This lets you choose from different settings, but we found that it takes getting used to. After you dial a number, for example, you have to hit a button that has a check mark on it. Likewise, you can't dial at all if the LCD is set on certain menus.

You can use the software client to make calls across an IP network with your Windows-based PC. Like the phones, the software is H.323-compliant and should work with other H.323-based devices. You can also use the software in conjunction with Microsoft NetMeeting to send data across the network and collaborate on projects.—SR

3Com NBX 100

18-extension, 6-trunk configuration, \$13,582 list. NBX 100 Communications System, Andover, MA; 888-629-0070, 978-749-0000; www.nbxcorp.com.



Of the three products that converge voice and data, we found the 3Com NBX 100 to be the most comprehensive. Unlike the Cisco CallManager and Siemens HiNet RC 3000, the NBX 100 comes with everything you need to place and receive voice calls over your existing Ethernet LAN—all for the very reasonable cost of \$755 per extension (including IP phones) in our configuration, compared with \$1,660 per extension for the CallManager and \$1,190 for the RC 3000. The system includes dual-port IP/Ethernet phones and integrated voice mail and auto attendant features, and it's scalable up to 120 devices and 100 lines. The components rely on QoS settings to ensure voice quality on your LAN. We found the sound to be as clear as the products that use a separate voice infrastructure. The only major drawbacks to the NBX 100 are its reliance on analog PSTN trunks for incoming dial tone and its inability to work with standard PSTN-based phones and fax machines. The Cisco and Siemens products force you to purchase a third-party gateway, which is less convenient

but provides more flexibility when it comes to trunk lines.

The NBX 100 starts at around \$3,500 for a solution with three Ethernet phones, four trunk ports, and an eight-port 10Base-T hub. The central system includes a six-slot, 19-inch, rack-mountable chassis. Each slot can be populated with an NBX 100 Network Call Processor, a four-port line card, or an eight-port Hub card. Each chassis can hold up to 20 trunk lines, using five four-port line adapters. You can stack up to five units together for a combination of 120 lines and phones. The call processor controls the call-setup, voice mail, auto-attendant, class of service, and computer telephony functions. All of these features can be accessed via a standard browser and a very simple GUI.

Once the phones are connected, they simply use the MAC addresses to alert the system to their presence. By default, the phones act as Ethernet devices and do not require dedicated IP addresses, which is important if you have a limited number of addresses. The only time a phone needs to lease an address is when the user makes a call outside of his subnet.

Not only does the phone offer two ports for connecting your PC to the same jack, it also offers 12 programmable buttons and an LCD that shows you basic information such as caller ID. In addition to the standard phone, 3Com offers an attendant phone that provides more programmable buttons for use by an operator or receptionist.

Another useful feature of the NBX is the five-level off-site notification setting. We were able to configure a phone extension so it could automatically send an e-mail or a page or even dial another number if a user is out of the office. You can also configure it to move from paging to dialing the alternate number to e-mailing after a preset amount of time. The NBX 100 lets you set up some basic class of service controls, such as hours during which users can make calls and whether the calls can be local, outside the office, or only to specific numbers.

You'll have to plan your Ethernet LAN carefully to use the NBX 100 (see "Prepare Your LAN for Voice"), but if you're looking to combine voice, telephony, and data, this is the best solution.—SR

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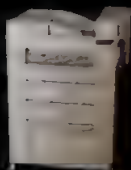
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Home PCs



\$600

PROCESSOR AMD K6-II/400, Cyrix MII/400, or Intel Celeron/433

MEMORY 32MB

GRAPHICS 4MB Integrated

HARD DISK 4GB

MONITOR None

OPTICAL DRIVES 24X CD-ROM

PERFORMANCE Winstone: 16.0

3D WinMark: 550

GOOD FOR Internet browsing, e-mail, word processing, light spreadsheet work, home finance

\$800

PROCESSOR AMD K6-II/450 or Intel Celeron/400

MEMORY 64MB

GRAPHICS 8MB AGP 2X

HARD DISK 8GB

MONITOR 15-inch

OPTICAL DRIVES 32X CD-ROM

PERFORMANCE Winstone: 18.5

3D WinMark: 800

GOOD FOR All tasks listed for \$600 systems, plus gaming, light image editing, desktop publishing

Here are the types of components you can expect to find at each price level. We also have estimated the typical performance of the machines using our ZD Business Winstone 99 benchmark test score (which uses nine of the most popular software applications to determine a machine's speed in day-to-day use) as well as our ZD 3D WinMark 99 suite (which indicates 3-D graphics performance for games).

A PC for Every Budget

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By Cade Metz

The home PC is no longer a luxury item. With so many PC vendors selling modest or refurbished hardware at discount prices, others claiming to offer free machines, and the rest continually lowering their prices to keep pace, you need not have an unusual income to have a PC. If you wish, you can still splurge \$3,000 on a machine with the latest hardware, but by sacrificing a little processing speed—which likely won't be missed—you can have a similarly equipped system for around half that price. If you're willing to settle for a low-end 3-D graphics engine and a less generous support policy, you can cut the price in half again. New, capable PCs are available from the market's leading manufacturers for no more than a few hundred dollars apiece.

\$1200

PROCESSOR AMD Athlon/500 or Intel Celeron/500
MEMORY 64MB
GRAPHICS 16MB AGP 2X
HARD DISK 13GB
MONITOR 17-inch
OPTICAL DRIVES 4X DVD-ROM
PERFORMANCE Winstone: 20.0
 3D WinMark: 980
GOOD FOR All tasks listed for \$800 systems, plus 3-D gaming, image editing, desktop publishing, occasional video editing

\$1600

PROCESSOR AMD Athlon/600, Intel Pentium III/500
MEMORY 128MB
GRAPHICS 32MB AGP 4X
HARD DISK 20GB
MONITOR 17-inch
OPTICAL DRIVES 6X DVD-ROM
PERFORMANCE Winstone: 22.0
 3D WinMark: 1,040
GOOD FOR All tasks listed for \$1,200 systems, plus frequent video editing and Web content creation

REVIEW CRITERIA

For this roundup, we invited the top home PC vendors, according to market share data from IDC (see the chart "Top Home PC Players"). The leading four—Compaq, Gateway, HP, and emachines—were invited to send two models each. Packard Bell NEC submitted a preproduction sample of its latest, which we cover in the sidebar "NEC Home Music Studio RS 500."

We concentrated on models in two price sweet spots: budget models that sell for around \$800 (including 15-inch monitors) and more full-featured PCs that sell

for around \$1,600 (with at least 17-inch monitors). Some fail to meet our specifications exactly, and with memory prices on the rise, some may carry higher prices by the time you read this. All are equipped for Internet access and other common home applications, but none use the absolute latest in PC technology.

Offering upmarket graphics engines, impressive audio subsystems, and DVD-ROM drives, many of the \$1,600 machines are ideal for video or image editing, playing 3-D games, or watching DVD movies. The \$800 PCs all include speakers and

Editors' Choice

• Micron Millennia Max 533 • HP Pavilion 6530



At the high end of the home PC spectrum, the Micron offering is excellent. Among the \$800 models, we found three we like, and one we love.

The Micron Millennia Max 533 (\$1,584 direct) delivered excellent performance, thanks to its 533-MHz Pentium III processor and 133-MHz bus architecture. The easy-access case has plenty of room for expansion, and the Max 533's components—Creative Labs 3D Blaster RIVA TNT2 Ultra graphics card, 13GB Western Digital hard disk, 8X NEC DVD-ROM drive, and three-piece Sonigistix Monsoon speakers—are top-notch. Add a three-year warranty (with first-year on-site service included) and outstanding Web support and the Max 533 edges out its like-priced competitors.

Still, those competitors—the Dell Dimension XPS T550 (\$1,588 direct), HP Pavilion 8500 Series (\$1,600 street), and Quantex M500 (\$1,599 direct)—deserve honorable mention. All posted strong numbers on our benchmark tests. Dell delivers unsurpassed Web support, the HP comes equipped with a

CD-RW drive (a rarity at this price), and the Quantex is loaded with an Iomega Zip 100 Drive and a 19-inch monitor, making it a relative bargain.

If you need to spend less (say, for a student machine or a second machine for less demanding tasks), there are several good choices. The HP Pavilion 6530 (\$800 street) delivers adequate performance, excellent documentation for home users, and passable upgrade potential for the money. Its better performance, coupled with HP's good showing on our latest Service and Reliability Survey, help it edge out the Compaq Presario 5440 (\$800 street). We also like the style, convenience, and value proposition of two all-in-ones: the emachines eOne (\$800 street) and Gateway Astro (\$799 direct). Each is easy to set up and cleverly designed, but the nearly nonexistent upgrade path makes them best suited to users who will be happy with the performance and features frozen in time.

some 3-D support but are best used with 2-D applications light on multimedia.

Thirteen of these systems are traditional PCs: mini-towers that connect to several external devices. Three use all-in-one designs, with stylized chassis that contain the core hardware, CRT monitor, and speakers. These three—the Apple, emachines eOne, and Gateway units—are easier to set up and use than their competitors, but they're not as easily upgraded—if at all.

WHAT YOUR \$1,600 BUYS

The typical \$1,600 home PC is a 500-MHz Pentium III with 128MB of RAM, a

12GB hard disk, a brand-name 3-D graphics card, a DVD-ROM drive, and a 17-inch monitor. It offers good multimedia, and it's capable of handling any 2-D or 3-D home application.

The new \$1,499 Apple iMac DV Special Edition, encased in translucent, graphite-gray plastic, is certainly the most visually appealing system. Equipped with a 400-MHz PowerPC chip, an ATI 3-D video chip, and a DVD-ROM drive, the iMac performs nearly as well as its competitors on common home applications and is better equipped than most for low-end video editing. The \$1,550 Sony VAIO

PCV-R536DS is similarly equipped for video editing, but it isn't as easy to use or as inexpensive as the iMac DV, and—with a Pentium III/450—it isn't as fast as most of its competitors.

Pentium III/600 CPUs aside, the Acer Aspire 6171 and the CompUSA PC Home Series are average \$1,600 machines. Acer provides technical support only during business hours, and the Home Series has only 64MB of memory and lacks DVD. The 500-MHz models from Dell, HP, Micron, and Quantex are more impressive, each with 128MB of memory and generally better peripheral hardware. Quantex also provides an Iomega Zip 100 Drive and a 19-inch monitor, and HP includes a CD-RW drive. The remaining two 500-MHz models—the Compaq Presario 5834 and the IBM Aptiva E Series 550—include CD-RW drives, but they perform much as the Sony does, with only 96MB of memory and lower-end graphics engines. The Micron Millennia Max 533 is the only unit with a 133-MHz bus. Whereas others here contain CPUs and core-logic that use 100-MHz bus speeds, the Max 533 has a 533-MHz Pentium IIIb chip and a VIA Apollo Pro 133A chip set.

Except for the 5834, the E-Series 550, and the PCV-R536DS, which performed poorly on our 3-D tests, all of these models are equipped for high-end games, and most offer respectable audio. These being home PCs, most vendors also provide helpful documentation, a keyboard with Internet controls, and at least a one-year warranty. Of course, some vendors offer much more, providing three-year warranties or on-site service, and others offer less, limiting space for upgrades or failing to include any printed documentation.

AND IN THE \$800 CORNER

The typical \$800 home PC is equipped with a Celeron or AMD K6-2 CPU, 64MB of RAM, a 6GB hard disk, integrated graphics, a CD-ROM drive, and a 15-inch monitor. Notably, it lacks DVD and performs at a much lower level than most \$1,600 models—especially on 3-D tasks. It's good mainly for Internet use and basic productivity apps. Moreover, vendors rarely provide three-year warranties or on-site service with such systems.

The Compaq Presario 5440 and the HP Pavilion 6530 are essentially smaller,

Our Contributors: CADE METZ is a senior writer at *PC Magazine*. BRUCE BROWN is a contributing editor of the magazine, and JON A. HILL is a frequent contributor. Senior associate editor JAMIE M. BSALES and PC Magazine Labs senior project leader RICHARD FISCO were in charge of this story.

slower versions of their \$1,600 counterparts. Help tools and technical-support hours are all the same (which is to say, very good), though the 5440—unlike the more expensive Compaq Presario 5834—does not include on-site service.

Encased in opaque off-white plastic, the Gateway Astro is less striking (and less expensive) than the iMac. Refreshingly easy to set up, it too integrates a 15-inch monitor and speakers. Lacking DVD and using the graphics engine integrated with the Intel 810 chip set, it's not as well equipped as the iMac DV, but it's \$700 cheaper—and it has a floppy disk drive.

Last, we review two PCs from emachines, which sells through retailers and resellers. Equipped with a 466-MHz Celeron and 64MB of RAM, the emachines etower 466id is a low-end mini-tower that's adequate for 2-D applications but couldn't run our 3-D tests. The emachines eOne is much more compelling. With an all-in-one design and translucent blue casing reminiscent of the original iMac, this Intel Celeron/433-based PC, like the Astro, lacks DVD but is balanced by a sub-\$800 price. And predictably, there's a rub: emachines customers are afforded only 15 days of free technical support.

OTHER WAYS TO BUY

Of course, your choices are hardly limited to these two price categories. Opting for a CD-ROM drive rather than DVD, can bring a \$1,600 system down to \$1,400. If you're willing to purchase through a Web outlet or settle for refurbished hardware, you can easily find a \$500 PC. Several companies even offer free PCs—or, at least, PCs at a nominal cost. The likes of DirectWeb, Enchilada, InterSquid, and MyFree-PC.com provide free hardware when you pay for a certain amount of Internet access. With the aptly named Free-PC, you receive free hardware and free Internet access, but much of your display is dedicated to advertising. The best offer comes from newcomer PeoplePC: For \$24.95 per month for three years, you get a 366-MHz Celeron PC, a full warranty (with on-site service), and unlimited Internet access.

Yet none of these free PCs are even as adept as the \$800 models reviewed here, and in reality, few are as inexpensive. If you'd rather have a system with good 3-D performance, a DVD drive, or an all-in-

one design, then read on. For \$800, you can have a modest but reliable machine for basic software tasks. For \$1,600, you can have a tricked-out multimedia PC that's only a step or two behind the fastest models on the market.

Acer Aspire 6171

Pentium III/600, 128MB RAM, 32MB ASUS AGP V3800 nVidia Riva TNT2 graphics card, 17.6GB hard disk, 6X DVD-ROM, 17" monitor. \$1,599 direct. Winstone score: 26.6. San Jose, CA; 800-733-2237; www.acer.com/aac.

● The Acer Aspire 6171 is a well-rounded package suitable for a range of home PC buyers. New users will appreciate the 6171's attention to detail; experienced users will recognize its top-flight performance and forward-looking components. It's worth a look, though consider the laudable competition from Dell, HP and Micron as well.

Color-coded connectors make setup fail-safe, and the speakers, keyboard, and mouse use convenient USB connections. We had the 6171 up and running in under 5 minutes. Setup continues with an interactive animated video that, among other things, performs modem diagnostics and

Apple iMac DV Special Edition

Building on the the original iMac, the DV Special Edition adds built-in video-editing support—if you have a digital video camera.



offers 90 days of free Internet access from MSN. Our favorite feature is Acer's TimeMachine utility, which can automatically roll system settings back to a previous working state should an Internet download or software addition cause glitches.

DVD-ROM playback was reasonable (MPEG decoding is handled in software), and the system's overall performance was consistently among the fastest in the roundup. The 6171's results on our ZD 3D Graphics WinMark 99 benchmark tests indicated strong if not overwhelming 3-D game performance.

Acer maintains an active Internet presence, offering direct sales, service package options, drivers, and bug fixes. The 6171 is a well-priced package that offers something for both novice and experienced users.—Jon A. Hill

Apple iMac DV Special Edition

PowerPC 350/400, 128MB RAM, 8MB ATI Rage 128 VR graphics card, 12.7GB hard disk, 4X DVD-ROM, 15" monitor. \$1,499 direct. Cupertino, CA; 800-795-1000. www.apple.com.

● Slick as ever, the translucent-graphite Apple iMac DV Special Edition is a touch

Top Home PC Players

The advent of ultra-affordable home PCs has helped reshuffle the deck, as witnessed by the rise of upstarts emachines and Microworkz.



Figures are for unit shipments in the U.S., January through June 1999. Source: IDC U.S. Quarterly PC Tracker (www.idc.com)

smaller and a bit more streamlined than the groundbreaking (and clone-spawning) original. Apple's TV commercials highlight the unit's video-editing capabilities, but be warned: This luxury is only for those with *digital* video cameras. Figure in middling performance and a severely constrained upgrade path and this iMac becomes a tougher sell. If you have become enamored with the iMac, the iMac DV is worth a look. Otherwise, look to the Apple G4/400, which delivers better performance and great expansion possibilities for about \$200 more.

True to its design goal, initial setup is simple enough that the iMac DV's quick-start guide consists of six color pictures. Once it's up and running, you can learn about the iMac DV through an interactive on-disk video. Apple supplies a good mix of software with this model, including AppleWorks (a midrange suite of office applications) and iMovie (a low-end video-editing package). The all-in-one design is great for cramped spaces, though there is a downside: You can access the iMac DV's memory slots via a recessed access panel or insert a \$199 AirPort Card (for wireless networking) or other peripheral into the iMac's PC Card slot, but that's about it for upgradability.

The real draw is the video-editing functions. A built-in FireWire port lets you easily connect a digital video camera or other FireWire-enabled digital video source—but there is no direct way to input plain old analog video. That's unfortunate, given the huge number of analog video cameras that have already been sold and the relative high price of digital models (about double that of a comparable analog model). There

is also no way to export your finished product to an analog video recorder: You need to send the edited version back out the FireWire port and into your digital video camera, and transfer it from there to tape. The USB ports do let you archive video to an external drive you supply.

Performance on our cross-platform tests was somewhat lackluster. The iMac DV performed on a par with the less-expensive Celeron/433-based emachines eOne on our Photoshop suite—and the \$800 eOne came equipped with only 64MB of RAM (versus the iMac DV's 128MB). We were also unimpressed with the iMac DV's DVD-playback performance. When we played the included DVD-ROM *A Bug's Life*, we had difficulty regaining control of the DVD-player

application, and when we attempted to move the DVD window, playback ceased.

Apple's Web presence is fairly comprehensive, including up-to-date driver revisions and bug fixes. You can custom-configure your PC, and the helpful Learn More buttons lead to explanations of the various component choices.—JAH

Compaq Presario 5440, 5834

5440: AMD K6-2/450, 64MB RAM, 8MB SiS 530 graphics (integrated), 6.2GB hard disk, 32X CD-ROM, 15" monitor, \$800 street. Winstone score: 13.8. **5834:** Celeron/500, 96MB RAM, Intel 810 graphics (integrated), 12.9GB hard disk, CD-RW, 17" monitor, \$1,400 street. Winstone score: 20.3. Houston; 800-888-0220; www.compaq.com.

● Students and first-time buyers who want both a low price and a brand name should consider the Compaq Presario 5440. The Presario 5834 delivers a strong software package combined with reasonable performance and higher-quality components than the 5440 has, but in the 5834's price range we preferred models from Dell and Micron.

The setup experience for both PCs is relatively painless. Compaq's Road Maps and User Guides are informative and easy to follow. All connections are color-coded or otherwise fail-safe, and we had the systems up and running in no time. Once set up, the Compaq Organizer software provides easily decipherable icons for diagnostics, remote support, and a host of links to Internet-based tutorials such as "My Presario" and "Welcome to Windows"; if you run into trouble, there's a built-in technician (named AI). Both systems come with Compaq monitors, quick-launch-key enhanced Internet keyboards, and JBL two-piece speakers of reasonable quality, but the similarities end there.

The 5440's software bundle includes Microsoft Works and McAfee VirusScan. The 5834's more robust package includes Microsoft Office and Encarta Reference Suite 99, as well as CeQuadrat's JustBurn suite of CD-recordable software to be used with the CD-RW drive. Also, the 5440's mini-tower case has nicely turned edges, much better than the sharp, stamped edges of the 5834's mid-tower case. Neither machine's motherboard provides an AGP graphics slot, so if you get tired of the anemic SiS 530 chip soldered onto the 5440's system board or the marginally more adept Intel 810 chip embedded in the 5834, you

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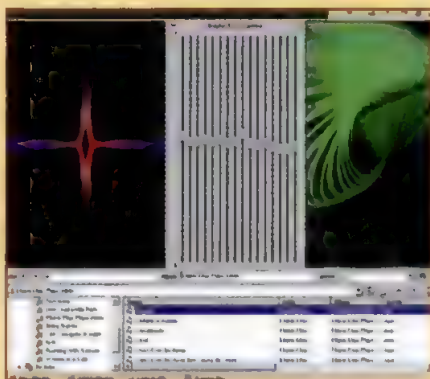
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NEC Home Music Studio RS 500

The Apple iMac DV Special Edition and Sony VAIO PCV-R536DS in this roundup tout video-editing capabilities out of the box, but Packard Bell NEC has a different spin: music. The company has combined a fairly powerful PC (complete with a CD-RW drive) with music-cataloging, music-composition, and CD-creation software to deliver a complete bundle for the audio enthusiast. With a little time and effort, you could cobble together the pieces that form the NEC Home Music Studio RS 500 yourself. The allure is that Packard Bell NEC has done most of the work for you.

Final versions of the Home Music Studio were not available in time for our roundup, but we were able to get our hands on an early working model. In hardware terms, the system is a standard Pentium III/500-based PC with an added CD-RW drive. With 96MB RAM, integrated 4MB SiS 6326 graphics, 13GB hard disk, 40X CD-ROM drive, and 17-inch monitor, the unit is slated to have a \$1,350 street price. Audio components include a Creative Labs Sound Blaster Live! Value Edition card and two-piece Harmon Kardon speakers, plus extra audio I/O: two analog-out jacks, a digital-out jack, and both line- and microphone-in jacks.

The Home Music Studio's software package is not confined to audio-related software: The system is also designed to be used as a general-purpose home PC. The Microsoft Windows 98-based machine comes with Adaptec's DirectCD, MGI PhotoSuite, Microsoft Money 99 Financial Suite, Microsoft Works, and Intuit's Quicken Basic. The stars of the HMS show, however, are two software packages from Sonic Foundry: Acid Style and Siren for NEC.



With Sonic Foundry's Acid Style, you can create your own riffs and save them as MP3 files.

Internet Radio, and Urocketmusic.com. Using Siren, you can also write an MP3 file directly to CD, but Packard Bell NEC is being very careful with the Home Music Studio: To avoid running afoul of the music recording industry, you must use one of the new CD-R disks designed for consumer audio recorders, which carry a surcharge granting prepaid rights to a CD's worth of songs.

The Home Music Studio provides a good starter kit—from music-related Internet links to CD labelers—for hobbyist-level recording engineers. Although its components' specifications are unlikely to satisfy demanding professionals, at the price levels contemplated by Packard Bell NEC (\$1,300 to \$1,700 street, depending on configuration), its connectivity and ease of use may have creative home users spinning their disks into the wee hours. (Packard Bell NEC Inc., Sacramento, CA; 800-524-0819; www.neccsd.com.)—JAH

will be limited to PCI-based replacements.

Neither machine performed particularly well on our benchmark tests. In particular, the AMD K6-2-based 5440 posted the lowest ZD Business Winstone 99 and ZD 3D Graphics WinMark 99 scores in the roundup. The 5834 managed better all-around performance, but again, 3-D graphics performance was poor compared with others in its price range. Blame the integrated graphics chips, which tap system memory for graphics functions.

Compaq provides a high level of customer support and maintains an active Internet presence, but the company's online store offers only some of the company's product line. Of the two, only the 5440 is available via Compaq.com, although the company does do a good job of providing both online and location-specific retailers that carry Compaq products.

If you value easy setup and a commitment to customer support more than cutting-edge performance, you might want to give these machines a look. But unre-

markable performance and constrained upgrade options may lead you back to the store for a new machine before you know it.—JAH

CompUSA PC Home Series

Pentium III/600, 64MB RAM, 16MB 3dfx Voodoo3 2000 graphics card, 13.0GB hard disk, 40X CD-ROM, Iomega Zip 100 Drive, 17" monitor. \$1,579 direct. Winstone score: 23.7. CompUSA Inc., Dallas; 888-226-6772; www.compusera.com.

● The 600-MHz CompUSA PC Home Series is a midsize tower PC intended for first-time PC buyers and students looking for performance now, plus the ability to expand the system later. It is a decent basic system though not a standout; we preferred the entries from Dell, HP, Micron, and Quantex in this price class.

Documentation is light—certainly not up to the standards set by Compaq, Dell, HP, and IBM in this area. There's nothing tricky about setting up the Home Series, and users are helped by a very good box-topper, but there's little other helpful

paper documentation other than separate component manuals and booklets. A documentation CD is included, but it covers many component models with no easy user references to their own systems. Troubleshooting documentation is particularly inadequate. On the plus side, there are ample empty card slots and drive bays for expansion.

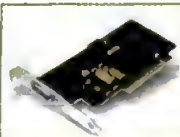
Norton AntiVirus loads when the system is first booted, with a wise suggestion that the new user scan the system. Desktop icons include 1-Step Backup and 1-Step Restore, plus an EarthLink ISP setup icon. Microsoft Works software is also included. Sound quality from the two-piece Altec Lansing speaker system was decent, not great. Although the Home Series has a fast processor, its 64MB RAM and 16MB graphics memory holds back overall system performance somewhat compared with others in this price range.

Right now, Web-based support is mixed for the Home Series, which is sold

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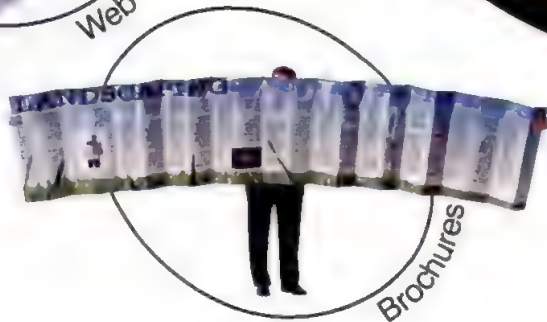
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A PC for Every Budget**Compaq Presario 3550:
A Slim, Sleek Space-Saver**

The new Compaq Presario 3550 is a desktop reminiscent of a notebook computer. Its main unit is a slender 3.3 by 12.1 by 12.5 inches (HWD) and connects to a 15-inch LCD. The entire system, from mouse to subwoofer, is in an ebony color, and the unit's edges are rounded rather than sharp. Few PCs are so interesting to look at: You aren't likely to find a more compelling PC for \$2,000 (street).

Like other Presario models, the 3550 is designed for the home, offering thorough documentation, a wizard for connecting to the Internet, software for restoring past hard disk images, and several other support tools. Compaq mounts a USB port, a headphone jack, and a microphone jack on the front of the system, and the keyboard includes audio as well as Internet controls. There's even a built-in CD-RW drive. The Celeron/500-based PC isn't meant for high-end performance using business software, but with a 15-inch digital display and Monsoon speakers it provides a sharp screen image and excellent audio. —*CM*

only in CompUSA stores. You can find drivers and options on the Web site, which is well organized, but the site lacks both a trouble-shooting wizard and online documentation. CompUSA has rolled out a new site, cozone.com, that offers advice on (and of course, sale of) a range of computer products. —*Bruce Brown*

Dell Dimension XPS T500

Pentium III/500, 128MB RAM, 32MB Dell nVidia TNT 2 graphics card, 13.6GB hard disk, 8X DVD-ROM, 17" Dell monitor. \$1,588 direct. Winstone score: 24.3. Round Rock, TX; 800-915-3355, 512-338-4400; www.dell.com.

● The Dell Dimension XPS T500 is one of the best home PCs for performance-oriented users. With excellent performance, features, and value for the dollar, the T500 deserves to make your short list.

This Dell system doesn't have extra convenience features (quick-launch keys on the keyboard, front-mounted USB ports) for home users that we've come to expect in this class, but the level of user guidance and system reference material

(both in print and on-disk) is very high. Oddly, not all information is specific to this particular PC.

The T500's Turtle Beach Montego II Quadzilla 3-D audio card paired with an Altec Lansing three-piece ACS-340 speaker system makes the system a fine party machine. The 8X DVD-ROM player with software decoding ably played DVD movies, although for family viewing you'll likely want to output to a large-screen TV or monitor—a feature not supported by the bundled graphics card.

The T500's 128MB of RAM, 32MB TNT2-based graphics card, and 7,200-rpm hard disk made it one of the best performers overall.

Dell's online support includes drivers, bug fixes, BIOS updates, and trouble-shooting, all helpful for users who want to figure out problems on their own. The standard three-year warranty with 24-

hour, 7-day toll-free technical support is ready when more help is needed. Dell system buyers can also sign up for the Dellnet ISP with one month of free access and link directly to Dell's technical-support group via the Web. The Dell XPS T500 is a safe choice ready to perform and entertain. —*BB*

emachines eOne, etower 466id

eOne: Celeron/433, 64MB RAM, 8MB ATI Rage XL 3D AGP graphics, 6.2GB hard disk, 32X CD-ROM, 15" monitor. \$800 street. Winstone score: 15.6. **etower 466id:** Celeron/466, 64MB RAM, 4MB ATI Rage Pro Turbo 2X AGP graphics, 8.1GB hard disk, 5X DVD-ROM, 15" monitor. \$730 street. Winstone score: 15.1. Irvine, CA; 877-566-3463; www.e4me.com.

● There's no denying the appeal of emachines' systems for home users. While the company's standard 15-day technical support policy (\$20 per incident after 15 days) is a disappointment (inexperienced users should buy an extended service contract),

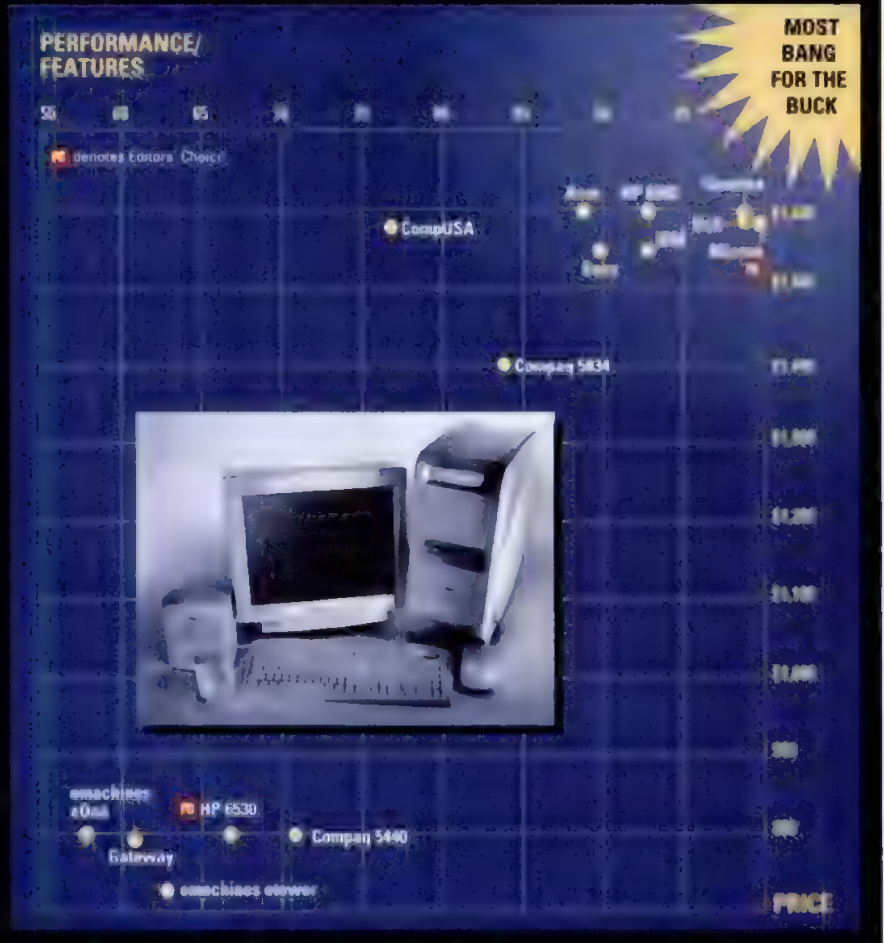
**Dell Dimension XPS T500**

A fine performer, the Dell Dimension also delivers the documentation help and extended support that home users need

Price/Performance Index: Home PCs

As expected, the machines we tested fell in two clusters: five less-expensive, less-powerful, and lesser-equipped models, and nine pricier but better-scoring PCs. (The Apple iMac is not plotted on this chart, as 50 percent of the overall score is based on performance results derived from our benchmark tests, which do not run on Mac OS.) Among the circa-\$800 home PCs, the Compaq Presario 5440 received the best overall performance/features score and is a good bet. Our favorite in this class is the HP Pavilion 6530. It performed relatively well, and HP outscored Compaq in our most recent Service and Reliability Survey. If you've got more to spend, the Micron Millennium Max 533 (\$1,584 direct) delivers the best value for the dollar, and merits our Editors' Choice.

THE DATA POINTS Features and components accounted for about 30 percent of the performance/features score, with a system getting extra points for a CD-RW or other removable-media drive, a DVD-ROM drive, and a larger monitor bundled by the vendor. Performance accounted for another 30 percent of the overall score. Other factors making up the overall score included service and support policies, expansion potential, overall ease of use, and Web support.



the hardware—though far from perfect—is enticing for the price. The eOne is clearly the more intriguing of the two systems, offering more components and connections than any other all-in-one PC on the market. The etower 466id is just another low-price, low-power computer.

The all-in-one eOne is what some might call an Apple iMac knockoff—that “some” including Apple, which has taken emachines to court. Still, the space-saving and cool-looking eOne has a number of design touches that show regard for user convenience. The USB keyboard has USB connectors for the mouse on both sides to accommodate both left- and right-handed users. There is a USB port on the front of the system case, where you’ll also find the CD-ROM drive, headphone jack, and floppy disk drive (a component notoriously missing from the iMac). One great feature is the ability to play and control audio CDs without powering up the PC—although you’ll want to supply your own powered speakers, because

the integrated speakers are terrible.

Like other all-in-ones, internal expansion is limited. The built-in PC Card slots, however, provide a helpful way to add storage or other peripherals. Unlike other machines in this price category, ports abound: two USB ports, two audio-in ports, a modem port, an 10BaseT Ethernet port, a jack for a Home PNA phone-line network connection, and an NTSC video-in port (for connecting a VCR or game console).

The setup literature and system documentation for the eOne are well done and, like the documentation included on disk, are specific to the components in the system. The eOne’s performance is adequate for most general applications, although it’s clearly not intended as a heavy-hitting game machine.

The etower 466id is a more conventional PC. It features a 15-pin game port and two USB connectors on the case front, but otherwise the port and peripheral-jack selection are typical for desktop

systems. Paper documentation was adequate, though it applied to the etower line, not this one in particular; documentation on disk was specific to the 466id model and more comprehensive than the paper manuals.

The tiny bundled speakers’ sound quality is not very good, though DVD movies played without halting or blurring. This expandable emachines PC has three free internal slots, one available internal drive bay, and two free IRQs. Here, too, performance was acceptable for productivity chores, but gamers will want a more powerful system.

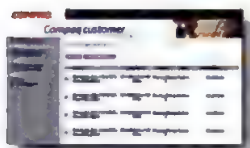
On the Internet you’ll find driver updates, a troubleshooting wizard, and a dealer list for emachines systems (you can’t order direct). Although neither of the tested emachines PCs is a heavy-performance system, and the company’s standard support policy is abysmal, both systems have appeal for the value of their included components and for their convenience-oriented design features.—BB

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Software Included

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- 56Kbps V.90 PCI FAX/Modem

Software Included

- Microsoft® Windows® 98 Second Edition
- Corel Wordperfect Suite 8

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- 32MB Synchronized DRAM
- VGA with DVT share memory
- Stereo Audio
- Expansion Slots: 3 PCI, 1 ISA
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Gateway Astro

Celeron/400, 64MB RAM, Intel 810 graphics (integrated), 4.1GB hard disk, 40X CD-ROM, 15" monitor. \$799 direct. Winstone score: 16.7. North Sioux City, SD; 800-428-3929. www.gateway.com.

● Similar in concept to the Apple iMac and the emachines eOne, the Gateway Astro all-in-one is designed to be a convenient, simple-to-use computer that does not take up much space. Clearly the Astro succeeds in its mission: It's ideal for PC novices, students, or those who need an affordable second machine and won't miss the ability to upgrade the unit.

Gateway has avoided the translucent, colored plastics of the eOne and iMac (and averted legal action by Apple, as well) in favor of a curvaceous but somewhat dull (relative to the iMac) beige housing. The Astro boasts five USB connectors for peripherals but no parallel port; you'll need to buy USB devices, or parallel-to-USB adapters for any existing printers or Zip Drives (and serial-to-USB adapters for your trusty joystick). A headphone jack on the front of the Astro and a modem jack on the back are the only other connections.



Gateway Astro

As easy to use as the Apple iMac, only more beige, the Gateway Astro is a good bet for students and PC novices.

Once you've plugged in just a few cables (power, modem, keyboard, and mouse), the Astro is ready to go. System documentation wasn't available in time for us to evaluate for this new design, but

Gateway generally has very comprehensive and well-executed manuals. One very helpful feature is a software window that opens on the Windows desktop for quick speaker volume adjustment and to change



In the **setup and getting started** portion of PC Magazine Labs' *ease of use* script, we look for documentation and utilities that get the system up and running. We expect to find a quick-setup poster or guide, color-coded cables and connectors, and full system documentation.

For **connecting to the Internet**, we like to see options and pricing explained for a range of ISPs, a long-term ISP membership included, and easy setup of dial-up options.

In the **general use** category, we find that the devil is in the details. Are the monitor and multimedia controls easy to use? Does the

unit have quick-launch application and Internet hotkeys?

For **service, support, and upgrading**, we look for a troubleshooting guide that covers all the system components, easy access to interior components and free slots, bays, and IRQs.

Our **Web support** rating indicates how user-friendly and complete the vendor's site is. We look for complete system specs and a way to contact technical support. Driver updates and troubleshooting support are pluses.

Online purchasing should be straightforward and secure. We check to see if you can order via the site, configure a system (and get an accurate price), and easily compare models.

EASE OF USE

	Setup and getting started	Connecting to the Internet	General use	Service, support, and upgrading	Overall Ease of Use	Web support	Online purchasing
Acer Aspire 6171	Good	Fair	Good	Fair	Fair	Fair	Fair
Apple iMac DV Special Edition	Excellent	Good	Fair	Poor	Fair	Excellent	Good
Compaq Presario 5440	Good	Good	Excellent	Fair	Good	Excellent	Fair
Compaq Presario 5834	Good	Good	Excellent	Poor	Fair	Excellent	Fair
CompUSA PC Home Series	Fair	Fair	Fair	Poor	Fair	Fair	Fair
Dell Dimension XPS T500	Good	Fair	Poor	Good	Fair	Excellent	Good
emachines eOne	Good	Poor	Fair	Fair	Fair	Fair	Poor
emachines etower 466id	Fair	Good	Fair	Fair	Fair	Fair	Poor
Gateway Astro	Good	Good	Poor	Poor	Fair	Excellent	Good
 HP Pavilion 6530	Good	Good	Good	Fair	Good	Excellent	Fair
HP Pavilion 8500 Series	Good	Good	Good	Fair	Good	Excellent	Fair
IBM Aptiva E-Series 550	Fair	Fair	Good	Fair	Fair	Excellent	Fair
 Micron Millennia Max 533	Good	Fair	Good	Good	Good	Fair	Good
Quantex M500	Poor	Poor	Fair	Fair	Poor	Good	Fair
Sony VAIO PCV-R536DS	Fair	Good	Good	Fair	Good	Excellent	Fair

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BENCHMARK TESTS

Home PCs



All the machines we tested are more than adequate for home chores, such as Internet browsing and word processing. You'll need one of the higher-priced machines for 3-D gaming or Web content creation.

The **ZD Business Winstone 99** test measures the time a PC takes to execute a set of scripts that exercise eight of the most popular Microsoft Windows 98 office-suite applications and an Internet browser. Not surprisingly, the units with the fastest processors proved to be the best Winstone scorers. The Acer Aspire 6171 combines a 600-MHz Pentium III CPU with a 7,200-rpm hard disk and an nVidia Riva TNT2 graphics chip and placed first.

Memory can also have a major effect on Winstone scores, as evidenced by the IBM Aptiva E Series 550 and the CompUSA PC Home Series. The IBM has a Pentium III/500 with 96MB of RAM, and didn't do as well as the other Pentium III/500s (from Dell, HP, and Quantex), which were equipped with 128MB of RAM. The CompUSA system came with a fast Pentium III/600 CPU with only 64MB of RAM (to fit our price filter), and trailed the Acer Pentium III/600 machine.

ZD CPUmark 99 is a processor-subsystem benchmark test that lets us measure the speed of a PC's processor subsystem, which includes the CPU, RAM, and RAM cache. CPUmark 99 emulates the CPU activity of the real-world 32-bit applications used in Business Winstone 99. In most cases, faster-clocked CPUs performed better than the slower-clocked ones. The exception was the K6-III/450 in the Compaq Presario 5440, which was beaten by the Celeron 400 in the Gateway Astro.

ZD 3D WinMark 99 helps us evaluate 3-D graphics performance and assess a PC's ability to execute certain 3-D rendering features. The suite is made up of 15 scenes; each scene is rendered by hardware if the graphics card was found to support all the 3-D options in the scene (based on the benchmark program's 3D Quality pretest). If not, the scene is not rendered, and the machine's overall score suffers. The suite relies heavily on

the system's graphics chip as well as the CPU's floating-point performance. In this roundup, systems based on the 3dfx Voodoo3 chip proved to be the fastest at the 16-bit color depth. But the Voodoo3 implementations couldn't handle 32-bit color, where systems employing nVidia's Riva TNT2 chips dominated.

◀ The Micron proved the fastest, with the HP Pavilion 8500 just two ticks behind. The Acer, Gateway, HP Pavilion 6530, and IBM could not maintain a 33.6-Kbps connection, and their scores suffered.

Model	Processor	Connection speed Kbps	Load Complex Pages Minutes:seconds	ZD WinMark 99
Acer Aspire 6171	Pentium III/600	26.4	4:56	100.0
Apple iMac DV Special Edition	PowerPC G3/400	26.4	8:17	100.0
Compaq Presario 5440	AMD K6-2/450	N/A	N/A	100.0
Compaq Presario 5834	Celeron/500	33.6	2:46	100.0
CompUSA PC Home Series	Pentium III/600	33.6	2:41	100.0
Dell Dimension XPS T500	Pentium III/500	33.6	2:52	100.0
emachines eOne	Celeron/433	33.6	3:00	100.0
emachines etower 466id	Celeron/466	33.6	3:04	100.0
Gateway Astro	Celeron/400	28.8	3:14	100.0
HP Pavilion 6530	Celeron/433	26.4	3:20	100.0
HP Pavilion 8500 Series	Pentium III/500	33.6	2:29	100.0
IBM Aptiva E Series 550	Pentium III/500	26.4	3:08	100.0
Micron Millennia Max 533	Pentium III/533	33.6	2:27	100.0
Quantex M500	Pentium III/500	N/A	N/A	100.0
Sony VAIO PCV-R536DS	Pentium III/450	N/A	N/A	100.0

N/A—Not applicable. The system could not perform this test.

◀ BETTER

the brightness and contrast on the integrated 15-inch monitor. Also, the speakers are barely adequate; you'll want to add your own powered (and remember: USB) speakers.

With its Celeron CPU and motherboard-integrated Intel 810 graphics chip set, the Astro isn't meant to be a speed demon. Still, it performed respectably for the price and should prove more than adequate for Web surfing and productivity chores but not serious 3-D gaming.

At this time, the Astro comes in just one variety with no options (a DVD-ROM option would be nice), but it is backed by Gateway's comprehensive online support, which includes everything from a troubleshooting wizard to bug fixes and BIOS updates.—BB

HP Pavilion 6530, 8500 Series

6530: Celeron/433, 64MB RAM, Intel 810 graphics (integrated), 6.2GB hard disk, 40X CD-ROM, 15" monitor. \$800 street. Winstone score: 15.6. **8500 Series:** Pentium III/500, 128MB RAM, 32MB ASUS AGP V3800 nVidia Riva TNT2 graphics, 12.4GB hard disk, 24X CD-ROM, CD-RW, 15" monitor. \$1,600 street. Winstone score: 23.7. Palo Alto, CA, 800-322-4772, www.hp.com



The HP Pavilion series is among the market's more polished and user-friendly home PCs. The two models we review here have very different internal hardware designs, but they're equally easy to set up and use, offering multiple software-based help tools and ample electronic documentation. The Pavilion 6530 is particularly worthy of note

among the \$800 machines.

One drawback to both systems is in upgradability: The smallish, crowded systems have only one free drive bay, two free PCI slots, and one free IRQ apiece. In most other respects, these are exemplary home PCs. Posters guide you through the setup process, and once you boot to Windows, a link on the desktop takes you to several video tutorials that explain the Microsoft GUI and a wizard that connects to any one of four ISPs (all of which offer free access time). HP also provides several other video tutorials (as part of its help interface), recovery software, and a full on-disk user's guide. Unfortunately, the latter isn't available in printed form. Both machines have keyboards equipped with audio and Internet controls.

ZD Content Creation Winstone 2000 measures the overall performance of a Windows 98 or Windows NT PC while running these top Internet content creation applications: Adobe Photoshop 5.0, Adobe Premiere 5.1, Macromedia Director 7.0, Macromedia DreamWeaver 2.0, Netscape Navigator 4.6, and Sonic Foundry Sound Forge 4.5. The benchmark program focuses on application "hot spots"—the subsystem-intensive moments where users have to wait for their PCs to catch up—and stresses the hard disk more. Among more expensive machines, the IBM Aptiva E-Series 550 was able to best the Acer Aspire, while the emachines eOne and Gateway Astro performed best among the \$800 entries.

Our new **i-Bench** benchmark program is a comprehensive cross-

▼ **The top performer, as measured by ZD Business Winstone 99, was the Acer Aspire, thanks to its 600-MHz processor. Among the lower-priced (around \$800) systems, the Gateway Astro PC was the fastest.**

The best scores on ZD 3D

WinMark belong to the Quantex M500 (at 16-bit color depth), which uses a 3dfx Voodoo3 graphics engine; and the HP Pavilion 8500 (at 32-bit color), which uses an nVidia RIVA TNT2 chip. The IBM Aptiva was best-in-class on Content Creation Winstone.

platform series of tests that measure both the speed and the scope of an Internet client's features when surfing the Web. The client can range from a browser on a PC to a wireless hand-held device—anything that can display standard HTML. We used a 33.6-Kbps connection on all the machines that would maintain that rate. If the modem could not connect at 33.6 Kbps, we used the maximum speed we were able to achieve. The **Load Complex Pages** test from the i-Bench suite times how long it takes a PC to load Web pages that have a mix of text and graphics. Since the connection speed is the bottleneck, systems achieving a 33.6-Kbps connection ran the best.

To run the tests, we stripped each system's start-up configuration of all processes or tasks except for Systray, Explorer, graphics card control panels, and ActiveX controls. We defragmented the hard disk before each test and let Windows 98 manage virtual-memory settings. For our 2-D tests we set the screen resolution to 1,024-by-768 at 32-bit color depth and set the monitor to 85-Hz refresh. We ran our 3-D tests at the same settings (when the PC could support them) and also at 16-bit color depth. For more detailed information on these tests, visit the online version of this story at www.pcmag.com.—Analysis written by Richard Fisco

High scores are best.			ZD 3D WinMark 99		ZD Content Creation Winstone 2000
Bold type denotes first place.			1,024 x 768, 16-bit color	1,024 x 768, true color	
denotes Editors' Choice.	Processor	ZD Business Winstone 99	ZD CPUmark 99		
Acer Aspire 6171	Pentium III/600	26.6	43.8	655	4b6
Compaq Presario 5440	AMD K6-2/450	13.8	18.9	164	N/A
Compaq Presario 5834	Celeron/500	20.3	34.3	294	N/A
CompUSA PC Home Series	Pentium III/600	23.7	42.0	718	N/A
Dell Dimension XPS T500	Pentium III/500	24.3	38.1	742	381
emachines eOne	Celeron/433	15.6	32.6	197	N/A
emachines etower 466id	Celeron/466	15.1	34.4	N/A	N/A
Gateway Astro	Celeron/400	16.7	29.8	309	N/A
HP Pavilion 6530	Celeron/433	15.6	31.5	280	N/A
HP Pavilion 8500 Series	Pentium III/500	23.7	38.3	803	858
IBM Aptiva E-Series 550	Pentium III/500	21.5	38.1	535	N/A
Micron Millennia Max 533	Pentium III/533	25.5	39.6	794	431
Quantex M500	Pentium III/500	24.4	38.1	946	N/A
Sony VAIO PCV-R536DS	Pentium III/450	22.1	34.9	482	N/A

N/A—Not applicable. The system could not run the test at this resolution.

The Apple iMac DV Special Edition is not included in this chart, because it cannot run our Windows 98-based benchmark tests.

The 8500's sound subsystem is respectable if unexceptional, but we were very impressed with its front-mounted USB and serial ports as well as its CD-RW drive—an unexpected bonus on a \$1,600 machine. Performance was very good across the board, and—gamers, take note—the nVidia Riva TNT2-powered graphics card powered the 8500 to first place on the true-color segment of our ZD 3D Graphics WinMark tests.

The HP Pavilion 6530 lacks a CD-RW drive, but its integrated audio hardware produces surprisingly good sound. Performance was acceptable for typical productivity chores.

You can purchase certain Pavilions via the HP Web site, but you can't custom configure them (though HP may add that

ability by the time you read this). The site does provide some of the market's better Web-based PC technical support. Unless you like to service your own machines or frequently add new hardware, you should be pleased with either of these Pavilions.—Cade Metz

IBM Aptiva E Series 550

Pentium III/500 96MB RAM, 8MB Number Nine SR9 S3 Savage 4 graphics, 16.5GB hard disk, 6X DVD-ROM, CD-RW, 15" monitor. \$1,550 direct. Winstone score: 21.5 Research Triangle Park, NC; 800-426-7255; www.ibm.com/pc/us

● Like IBM's ebony-black Aptiva S Series home PCs, the company's less conspicuous beige-colored Aptiva E Series machines rank among the market leaders in terms of bundled help tools and performance on common multime-

dia applications. Unfortunately, the IBM Aptiva E Series 550 we tested had a tendency to reboot suddenly in the middle of important tasks, a problem not resolved by the time testing ended. A middling performer in its class, it's difficult to recommend over like-priced models from Dell and Micron.

Short and compact, the Aptiva takes up very little room, but it won't accommodate more than a few additional peripherals: There are no available drive bays and only one free IRQ (though two free PCI slots are a plus). The system is fairly easy to set up, operate, and service. IBM includes extensive help software, a keyboard equipped with several application and audio controls, a recovery CD, and a set of diagnostics utilities. The IBM

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16MB nVidia TNT2 AGP2X graphics	32MB TNT Pro graphics	32MB nVidia GeForce 256 AGP4X graphics	
PCI 128-voice Wavetable sound	PCI 128-voice Wavetable sound	PCI 128-voice Wavetable sound	
Advent 009 speakers	Advent 009 speakers	Monsoon MM700 3-piece speaker system	
3Com USRobotics V.90 WinModem	3Com USRobotics V.90 WinModem	3Com USRobotics V.90 WinModem	
5-yr./3-yr. Micron Power limited warranty	5-yr./3-yr. Micron Power limited warranty	5-yr./3-yr. Micron Power limited warranty	
Microsoft Windows 98	Microsoft Windows 98	Microsoft Windows 98	
Microsoft Office 2000 Small Business Suite	Microsoft Office 2000 Small Business Suite	Microsoft Office 2000 Small Business Suite	
Norton AntiVirus	Norton AntiVirus	Norton AntiVirus	

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The left side of the tower case releases easily for interior system access, and expansion room in the Max 533 includes five available PCI slots, three externally accessible drive bays, and two internal drive bays. There were also two free IRQs in our test system. This array of slots and bays and system resources mean you can add peripherals to the Micron to increase capacity or meet specific application needs.

The 8X DVD player with software decoding did a fine job with DVD movies, and the high-end Sonigistix Monsoon MM-700 flat-panel speakers delivered extremely clear reproduction. Thanks to its processor and 133-MHz bus, this machine was a top performer on our ZD Business Winstone 99, CPUmark 99, and Content Creation Winstone tests.

Web-based support includes drivers, bug fixes, and a trouble-shooting wizard, but no online documentation. You can configure and purchase a Micron system via the Internet or via telephone. A generous warranty—three years (five years on the CPU and memory) with first year on-site service standard—add to this machine's appeal for savvy home users.—BB

Quantex M500

Pentium III/500 128MB RAM, 16MB 3dfx Voodoo3 3000 graphics card, 18.4GB hard disk, 6X DVD-ROM, Iomega Zip 100 Drive, 19" monitor, \$1,599 direct. Winstone score: 24.4. Somerset, NJ, 800-346-6572, www.quantex.com

● The Quantex M500 delivers a lot of bang for the buck. Our test unit was equipped with an Iomega Zip 100 Drive and a 19-inch monitor (17-inch was the norm for this price range) and still made it under our \$1,600 price cap. The only item that marred the bundle was the underwhelming MLI 450 speakers.

The M500's documentation is not as comprehensive as that of Dell, Micron, and others: The quick-start guide covers some but not all of the components included, and there is no overall system manual but rather separate component manuals. The Quantex case cover loosens with three thumb screws to reveal two free PCI slots, two external drive bays, and three internal drive bays. There is also one free IRQ.

DVD video playback was fine, but the

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SUMMARY OF FEATURES

Home PCs

☐ YES ☐ NO	Acer Aspire 6171	Apple iMac DV Special Edition	Compaq Presario 5440	Compaq Presario 5834	CompUSA PC Home Series	Dell Dimension XPS T500	emachines eOne
Price of tested configuration	\$1,600 street	\$1,499 direct	\$800 street	\$1,400 street	\$1,580 direct	\$1,588 direct	\$800 street
Processor	Pentium III/600	PowerPC G3/400	AMD K6-2/450	Celeron/500	Pentium III/600	Pentium III/500	Celeron/433
Chip set	Intel 440BX	Apple	SiS 530	Intel 810	VIA Apollo Pro 133	Intel 440BX	Intel 440LX
Installed/maximum RAM	128MB / 384MB	128MB / 512MB	64MB / 384MB	96MB / 256MB	64MB / 768MB	128MB / 768MB	64MB / 192MB
L2 cache	512K	512K	512K	512K	512K	512K	128K
Hard disk capacity (formatted)	17.6GB	12.7GB	6.2GB	12.9GB	12.9GB	13GB	6.2GB
Manufacturer and model	Quantum Fireball Plus KA	Info not available	Quantum Fireball CX	IBM Deskstar 22GXP DJNA-371350	Western Digital Expert WD 313500	IBM Deskstar 22GXP DJNA-371350	Seagate U4 6421 ST36421A
Rotational Speed (rpm)	7,200	7,200	5,400	7,200	7,200	7,200	5,400
Monitor size (diagonal, in inches)	17	15	15	17	17	17	15
Manufacturer and model	Acer Aspire 77s	Apple iMac	Compaq MV520	Compaq MV270	CompUSA DH-1764	Dell M780	emachines eview 15s
Graphics card	ASUS AGP V3800	Integrated on motherboard	Integrated on motherboard	Integrated on motherboard	3dfx Voodoo3 2000	Dell/nVidia RIVA TNT2	Integrated on motherboard
Graphics chip set	nVidia RIVA TNT2	ATI Rage 128 VR	SiS 530	Intel 810	3dfx Voodoo3	nVidia RIVA TNT2	ATI Rage XL 3D AGP
Graphics memory	32MB SDRAM	8MB SDRAM	8MB SDRAM	System memory	16MB SDRAM	32MB SDRAM	8MB SDRAM
Optical drive speed and type	6X DVD-ROM	4X DVD-ROM	32X CD-ROM	32X CD-ROM	40X CD-ROM	8X DVD-ROM	32X CD-ROM
Manufacturer	Hitachi	Matshita	Compaq	Compaq	Delta	Hitachi	Samsung
Other storage device	None	None	None	Sony CD-RW	Iomega Zip 100	None	None
MPEG-2 decoder	Software	Hardware	None	None	None	Software	None
Sound card or chip set model	ESS Solo-1	Harmon Kardon Odyssey	ESS Solo-1	ESS Solo-1	Creative Labs ES1373	Turtle Beach Montego II Quadzilla	Cirrus Logic CrystalClear
Speakers	Internal Altec Lansing	Harmon Kardon Odyssey	JBL Pro-Premium	JBL Pro-Premium	Altec Lansing ACS95W	Altec Lansing ACS340	Internal Cirrus Logic
Number of pieces	2	2	2	2	2	3	2
V.90 modem	Acer Data Fax	Info not available	Lucent Winmodem	Conexant HCF	Archtek ESS Fax/Data	US Robotics Voice Win	Intel (integrated)
Expansion slots: 32-bit PCI / ISA / Shared	2 / 1 / 1	N/A	2 / 1 / 1	4 / 0 / 0	2 / 1 / 1	4 / 1 / 1	N/A
Front-accessible drive bays: 5.25" / 3.5"	2 / 2	0 / 0	2 / 2	3 / 2	2 / 1	2 / 3	1 / 1
Internal drive bays: 5.25" / 3.5"	0 / 0	0 / 0	0 / 1	0 / 1	0 / 1	0 / 1	N/A
Number of parallel/serial/mouse ports	1 / 0 / 0	0 / 0 / 0	1 / 1 / 1	1 / 1 / 1	2 / 2 / 1	1 / 1 / 1	0 / 1 / 1
Number of USB / IEEE-1394 ports	4 / 0	2 / 2	2 / 0	2 / 0	2 / 0	2 / 0	2 / 0
Number of free IRQs	1	0	2	1	1	1	2
Keyboard manufacturer	Acer	Apple	Compaq	Compaq	Mitsumi	Dell	emachines
Quick-launch application/Web keys	☐ ☒	☐ ☐	☒ ☒	☒ ☒	☐ ☐	☐ ☐	☒ ☒
Volume/CD controls	☒ ☐	☐ ☐	☒ ☐	☒ ☐	☐ ☐	☐ ☐	☐ ☐
Mouse manufacturer	Acer	Logitech	Compaq	Compaq	Mitsumi	Microsoft	emachines
Scroll function	☐	☐	☒	☒	☒	☒	☒
Free ISP membership included	90 days	30 days	150 hours	150 hours	45 days	1 month	None
Name of ISP	Microsoft Network	America Online	Compaq.net	Compaq.net	EarthLink	Dell.net	N/A
Technical support hours (eastern time)	8:00-8:00 M-F	9:30-9:30, 7 days	24 hours, 7 days	24 hours, 7 days	24 hours, 7 days	24 hours, 7 days	8:00a-midnight, 7 days
Standard warranty on parts/labor	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	3 years/1 year	1 year/1 year
On-site service charge for 1 year	N/A	\$108	\$79	Included	N/A	Included	N/A

N/A: Not applicable—The product does not have this feature.

bundled speakers were weak. Spend a few dollars more for one of the other speaker systems available via the online configuration tool. Performance results were very good, and the 3dfx Voodoo3 graphics engine powered the unit to first place on our ZD 3D Graphics WinMark test (at 16-bit color).

Support on the company's Web site is decent, with drivers and a troubleshooting wizard. With good performance and a great hardware bundle (save

for the speakers), the Quantex is worth a look.—BB

Sony VAIO PCV-R536DS

Pentium III/450, 128MB RAM, 9.8MB ATI Xpert 99 graphics, 9.8GB hard disk, 8X DVD-ROM, 17" display. \$1,548 direct (after \$100 rebate). Winstone score: 22.1. San Jose, CA; 888-476-6972; www.ita.sel.sony.com.

● The Sony VAIO line's claim to fame is the built-in video-editing capabilities. If you plan on taking advantage of those features, this Sony VAIO PCV-R536DS

is worth a look—but note that similarly priced models from Dell, HP, Micron, and Quantex deliver faster processors, higher-end graphics adapters, and larger hard disks for the same money.

The lavender and gray VAIO case has front and rear IEEE-1394 (*iLink*, in Sony-speak) ports for connecting a digital video camera or other device. As with the Apple iMac DV Special Edition, there's no provision for analog input from a traditional video camera. Unlike

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emachines etower 466id	Gateway Astro	HP Pavilion 6530	HP Pavilion 8500 Series	IBM Aptiva E Series 550	Micron Millennia Max 533	Quantex M500	Sony VAIO PCV-536DS
\$730 street	\$799 direct	\$800 street	\$1,600 street	\$1,550 street	\$1,584 direct	\$1,599 direct	\$1,550 street
Celeron/466	Celeron/400	Celeron/433	Pentium III/500	Pentium III/500	Pentium III/533	Pentium III/500	Pentium III/450
Intel 440LX	Intel 810	Intel 810	Intel 440BX	Intel 440BX	VIA Apollo Pro 133	Intel 440BX	Intel 440BX
64MB / 256MB	64MB / 64MB	64MB / 256MB	128MB / 256MB	96MB / 256MB	128MB / 768MB	128MB / 256MB	128MB / 256MB
128K	128K	128K	512K	512K	512K	512K	512K
8.1GB	4.1GB	6.2GB	12.4GB	16.5GB	13GB	16.4GB	9.8GB
TriGem SV0844d/TGE	Quantum Fireball CR	Seagate U4 6421 ST36421A	Quantum Fireball CX	Maxtor DiamondMax 91728D8	Western Digital Expert WD 313600	Maxtor DiamondMax 91700U5	Quantum Fireball CX
5,400	5,400	5,400	5,400	5,400	7,200	7,200	5,400
15	15	15	15	15	17	19	17
emachines eview 15s	Gateway Astro	Hewlett-Packard M50	Hewlett-Packard M50	IBM C50	Micron 700CX	Quantex XP190N	Sony Trinitron 200ES
Integrated on motherboard	Integrated on motherboard	Integrated on motherboard	ASUS AGP V3800	Number Nine SR9	Creative 3D Blaster RIVA TNT2 Ultra	3dfx Voodoo3 3000	ATI Xpert 99
ATI Rage Pro Turbo 2X	Intel 810	Intel 810	nVidia RIVA TNT2	S3 Savage4	nVidia RIVA TNT2	3dfx Voodoo3	ATI Rage 128 VR
4MB SDRAM	System memory	System memory	32MB SDRAM	8MB SDRAM	32MB SDRAM	16MB SDRAM	8MB SDRAM
5X DVD-ROM	40X CD-ROM	40X CD-ROM	6X DVD-ROM	6X DVD-ROM	8X DVD-ROM	6X DVD-ROM	8X DVD-ROM
Samsung	Samsung	Samsung	TEAC	Hitachi	NEC	Toshiba	Pioneer
None	None	None	HP CD-RW	Sony CD-RW	None	Imega Zip 100	None
Software	None	None	None	Software	Software	Software	Hardware
Cirrus Logic SoundFusion	Info not available	Hewlett-Packard Riptide	Aureal Vortex AU8830	ESS Solo-1	Creative SB Live!	Aureal Vortex AU8820B2	Aureal Vortex AU8330
Info not available	Internal Phat Stereo	Polk Audio E	Polk Audio AMR1	Infinity	Sonigistix Monsoon MM-700	MLI 450	Sony SRS-Z050V
2	2	2	2	2	3	3	2
Rockwell ITU	Motorola SM56K	Lucent Winmodem	Lucent Winmodem	Rockwell HCF	U.S. Robotics Winmodem	Lucent Winmodem	Lucent Winmodem
1/1/1	N/A	3/0/0	4/1/0	2/0/1	6/0/0	3/2/1	3/0/0
2/1	0/0	2/1	3/1	2/2	3/2	3/2	2/1
0/1	N/A	1/0	0/1	0/0	0/4	4/0	0/2
1/2/1	0/0/0	1/1/1	1/1/1	1/2/1	1/2/1	1/2/1	1/2/1
2/0	5/0	2/0	1/0	2/0	2/0	2/0	2/2
2	6	1	1	1	2	1	0
emachines	Gateway	Hewlett-Packard	Hewlett-Packard	IBM	Micron	NEC	Sony
■ ■	□ □	□ ■	■ ■	■ ■	□ □	■ ■	■ □
■ □	□ □	■ □	■ ■	■ ■	□ □	■ ■	□ □
emachines	Gateway	Hewlett-Packard	Hewlett-Packard	IBM	Micron	Logitech	Sony
□	■	■	■	□	■	■	■
None	None	Varies	Varies	100 hours	45 days	30 days	Varies
N/A	N/A	Varies	Varies	IBM Internet	EarthLink	Varies	Varies
8:00a-midnight, 7 days	24 hours, 7 days	24 hours, 7 days	24 hours, 7 days	24 hours, 7 days	24 hours, 7 days	24 hours, 7 days	24 hours, 7 days
1 year / 1 year	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	3 years/3 years	3 years/1 year	1 year/1 year
N/A	N/A	N/A	N/A	N/A	Included	Included	N/A

the iMac DV, the Sony can be fitted with an internal video-capture card in case you need analog input and output to take advantage of the preloaded video-editing applications.

When you first boot the system, one wizard lets you quickly register the unit with Sony (which upgrades your warranty from 90 days to one year) and a second connects you to the Internet. Sony provides good documentation—both in print and on-disk—as well as a recovery

CD. We were most impressed, however, by Sony's software bundle, which includes Adobe's PhotoDeluxe and Premiere LE image-editing apps and such Sony apps as DVGate (for capturing and editing videos), Smart Capture (for sending video-based e-mail), and PictureGear (for organizing and editing still images), not to mention Quicken Basic and Microsoft Encarta, Money, Word, and Works.

The PC's sound system—an Aureal 3-D sound card and two Sony speakers—

is respectable, and its DVD playback is flawless. Its 450-MHz processor and 8MB ATI graphics engine meant the VAIO trailed some of the similarly priced systems we tested.

Though you can purchase the Sony VAIO PCV-R536DS over Sony's Web site, you can't (at least at the moment) custom-configure its hardware. On the plus side, the Sony site's support database is unusually well organized and quite helpful.—CM **PC**

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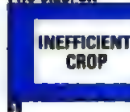
- 64MB SDRAM

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Efficient GIF Technique

File size: 6K



1



2

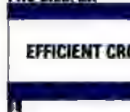


3



4

File size: 2K



1



2



3



4

You can crop the individual frames in an animation to reduce file size. The smaller the cropped rectangle, the smaller the file. In this case, the file size of the animation on the bottom is one-third that of the animation on the top.

File size: 8K



Here, the neon glow (bottom) contains fewer colors and is half the size of a soft anti-aliased glow (top) while producing a similar, attention-grabbing effect.

File size: 4K



Create Effective Web Animations

How to design your GIF banner ads so that they're quick to download and visually exciting.—By Luisa Simone

Animated GIFs remain the most popular way to add movement to a Web page. In fact, they're the de facto standard for banner ads on the Internet. The reason is simple: Most people who surf the Web can actually see a GIF animation unfold, regardless of the computer they own or the type of browser they use. This contrasts with Flash, Java, and Dynamic HTML, which are very robust and increasingly popular formats, but which require special plug-ins, downloadable applets, or the newest browser in order to be viewed.

Animated GIFs are based on one of the oldest of all animation principles—the flip book. Basically, an animated GIF file contains a series of individual images that, when viewed in sequence, create the illusion of movement. The problem is, saving a sequence of images can produce very large file sizes. Large file size is anathema on the Web, where it results in lengthy download times. Advertisers want the audience to see the entire message, which means the animated banner ad must display quickly. Download speed is determined by file size, and this speed is so important that most large Web sites have instituted strict size limits for files. The rule of thumb is that a banner ad should never be larger than 12K.

There are some standard techniques that can help you optimize the size of a GIF image. These include reducing the number of colors in the image, reducing the number of frames, cropping the dimensions of individual frames, and

avoiding dithered colors altogether.

All of these techniques are based on the premise that less is better. Fewer colors, fewer frames, and fewer frame-to-frame changes result in smaller files. But less is also boring. Ultimately, a banner ad that isn't visually interesting isn't effective. We'll show you how to create dynamic animated GIF banners that download efficiently and play back smoothly.

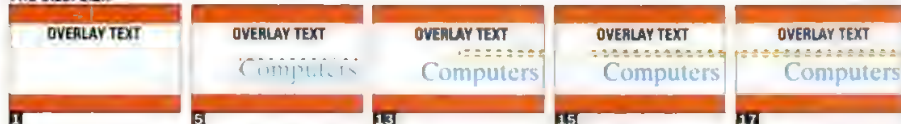
Animated GIFs have been around for a long time, and because of this they exhibit certain intrinsic limitations. For example, the format is restricted to 256 colors and employs the older LZW compression scheme. Furthermore, it displays the images in a strict sequence that you cannot modify at playback time. But it also supports some wonderful features. You can determine the amount of time each frame is displayed on-screen, make areas transparent, and choose the disposal method by which new image data replaces old.

If you understand these admittedly technical concepts, you'll be able to design animation sequences that take advantage of them. The following tips show you the kind of content that works hand-in-hand with GIF optimization techniques.

Most of today's full-featured Web graphics programs, such as Macromedia Fireworks (www.macromedia.com) and Adobe ImageReady (www.adobe.com), provide access to these functions. We generated the sample animations for this article using Fireworks.

Reducing the number of colors and frames need not make an animation boring.

File size: 5.2K



You can build up interesting animations by layering small images over a static background. In this animation, the three yellow lines (in frames 13, 15, and 17) appear to draw a rule across the screen.

File size: 4K



You can use visual clues, traditionally employed by cartoonists, to suggest movement with a minimum number of frames. Here, a motion blur and a directional slant take the place of several incrementally placed frames to create the illusion of motion.

SLOW DOWN (OR SPEED UP) THE ANIMATION

The GIF 89A format allows you to determine the delay between individual frames of an animation (specified in 0.01-second increments). This gives you the power to control the pace of the animation. Aesthetics aside, in many cases you'll find that slowing an animation down (or speeding it up) allows you to reduce the overall number of frames in the file.

For example, an animation containing a text phrase must be displayed on-screen long enough for the viewer to read it comfortably. You can either create four identical frames that each display for the default amount of time (0.2 seconds), or you can create one frame and specify an exact delay time of 0.8 seconds. In a GIF file that has not been otherwise optimized, deleting three frames from a four-frame animation can reduce the file size by 75 percent.

The same technique works in reverse. You can often create a more believable motion effect in fewer frames by decreasing the delay time to 0.1 seconds or less. To see this theory in action, examine the animation with the words "The illusion of motion" above, where the first frame is set at 0.6 seconds and the remaining three frames are set to 0.1 seconds.

CROP AWAY REDUNDANT IMAGERY

The first frame of a GIF animation typically determines the overall dimensions of the image, but subsequent frames can be smaller. They can even be positioned, using relative *x*, *y*-coordinates, anywhere within the boundaries of the first image. You can use this feature to crop away redundant image data and reduce the overall size of the file. The process may sound complicated, but it is often as simple as activating an export option. For example, Macromedia Fireworks contains an *Auto Crop* check box in the *Export* dialog box. In some rare cases, you can achieve a tighter crop (and save one or two more kilobytes) by using a dedicated utility such

as Alchemy Mindworks GIF Construction Set Professional to crop each frame manually.

This cropping technique works best when you plan your animation with cropping in mind. Basically, you should restrict the frame-to-frame changes to a small, contiguous area. In addition, you should make sure that the new image data completely obscures the part of the picture you want to erase from the previous frame.

The two sample animations in our first example above prove this point. The inefficiently cropped image contains only a small amount of change in each frame. And yet, because the changes appear in several different locations, a great deal of redundant information must be retained when the subsequent frames are cropped. The changes in the efficiently cropped image occur in the same location, and each new element hides the object beneath it. As a result, a very small cropped rectangle can encompass all of the necessary image data.

When you choose a particular animation technique, think about how well it fits into a cropped rectangle. Glows, for example, which rely on a color change, work well with cropping. Enlarging a shape while keeping it in the same position is also a good choice. A true motion effect is the least efficient animation option, because you must paint the new position of the moving object and repaint the background to hide the previous position of the object.

LAYER IMAGES IN AN ANIMATION

You can create amazingly small animated GIF files by taking advantage of two different features of the file format: GIF files can contain transparent areas, and the format allows you to determine how each frame in an animation will be repainted, or disposed of. If you build an animation by merely layering new image data over old—allowing portions of the previous frame to show through—you can create frames with large transparent areas. Transparent areas com-

Get Back Your Domain Name

Someone already registered the URL that I wanted to use. How do I find out who owns it in case I want to buy the rights?

Tim Lynch
Kalamazoo, Michigan

There are a lot of domain-name query engines that will tell you whether a URL is available, but most do not reveal the name and contact information of the registered owner. Network Solutions, the company that used to have the exclusive rights to assigning and managing URLs, has a useful utility located at www.networksolutions.com/cgi-bin/whols/whols. On this Web page, you can search for Web addresses, NIC handles, host computer IP addresses, or names.

A typical search, in which you enter a Web address such as *pcmag.com*, shows the registrant's address, domain name, contact information, and domain servers. If you search for a name (in last name, first name format), the search returns a list of matches with e-mail addresses and telephone numbers. Note that the Whois site does not contain information about military and government domains and contacts. —Bruce Brown

A Paper Web

How do I get automatically printed hard copy of selected Web pages?

S. Than
Wilmington, Delaware

If you have more money (to spend on ink cartridges and toner) than time, or if you just prefer to read printed output of Web pages, Hewlett-Packard's free printing utility, HP Instant Delivery (www.instant-delivery.com), is a nifty way to schedule hard-copy output, whether you use an HP printer or any other Windows-compatible printer.

After downloading the software (a 3.4MB file), run the installation program and set up your print schedule. You can also order a free CD from HP at the above URL. If you select free downloads and printouts of publications showcased at the HP site, which include such titles as CBS Sportline,

Dilbert, National Geographic Online, Time, USA Today, and the Wall Street Journal, you can choose to receive the pages at the default time set by each publication or at the time and day(s) you specify.

You can also schedule downloads of any Web page that can be printed, although the formatting likely won't be as polished as with the showcase publications. You can submit personal, company, and organizational Web pages for publication via Instant Delivery, but if you do so, the content becomes the property of HP.

HP Instant Delivery is compatible only with Windows 95, 98, and Windows NT 4.0. Be advised that if you print with a color printer, Instant Delivery is a great way to burn through expensive consumables. —BB

Safety for Shared Internet Access

Shared Internet access sounds like a great idea. Are there any drawbacks to doing this?

Paula Mitchell
Sacramento, California

If you access the Web via a network, there's a potential security risk that outsiders could view, access, or even destroy your computer's data. Anyone on a network must be sure that only authorized persons have access to shared drives and files; when you share Internet access, whether via dial-up, DSL, cable modem, or direct Internet connection, you must have protection.

One way to restrict access to your files is by using passwords on drives, folders, or even individual files. If password protection doesn't reassure you, turn file sharing off (*Start | Settings | Control Panel | Network | File and Print Sharing*).

Another way to keep outsiders out is by using a firewall program, which on a large-scale network is maintained by IS personnel, but on a smaller scale is included in Windows 98 Second Edition's Internet Connection Sharing and used with peer-to-peer networks. The financial, productivity, and entertainment advantages of shared Internet access come with the risk of data vulnerability. —BB

press very well, because they're treated as expanses of solid color by the compression algorithm. In addition, you can choose the most efficient disposal method, which is no disposal at all, or *None*. If you are using a program that automatically optimizes GIF animations, be sure to activate the Auto Differencing option and to specify which areas of the frames should be transparent.

Our sample overlay text animation, which consists of 17 frames, contains lots of action and still manages to keep the file size under 6K. The illustration here shows you a few selected frames from the animation to demonstrate the small amounts of data that are added with each frame.

KEEP THE COLOR PALETTE SMALL

The GIF 89A format stores all of the animation's colors either in one global palette or in a series of local palettes. Your first goal should be to eliminate local palettes. Utilizing one global palette for the entire animation means that colors are consistent from frame to frame, which results in a higher percentage of redundant image data that can either be cropped or converted to transparency. In contrast, a GIF animation compiled from a series of images with different palettes might contain color shifts that increase the size of cropping rectangles and interrupt transparent areas.

In addition, the fewer colors in the palette, the smaller the file size. Smaller palettes require less storage space. So a 16-color palette requires 4 bits, while a 128-color palette requires 7 bits. It should come as no surprise that images composed of flat areas of color—specifically text, logos, and computer-generated graphics—work best with small palettes. Photographic images or gradient fills should not be your first choice when designing an animated GIF because they contain lots of different colors that can bloat the palette.

Be on your guard against introducing new colors as part of a special effect. For example, the ever-popular soft drop shadow can add 8 or 16 gray tones to the palette. Animated glows and true optical fades are hogs when it comes to color requirements.

You can often create much smaller animated GIF files by substituting bandwidth-efficient effects. For example, instead of a fade that changes the color of an object frame by frame, use an old-fashioned dissolve transition, which paints a random, solidly colored spray pattern over an image. Likewise, instead of a pulsating, soft-edged glow, you can animate a neon outline for an object. Compare the

glow animation sample illustrations. The transparent halo effect looks more sophisticated but produces a file twice as large as its simpler outlined counterpart.

CREATE THE ILLUSION OF MOVEMENT

Ultimately, all animations are nothing more than illusions, where a fast sequence of static frames tricks your eye into seeing movement. However, there are certain visual clues—which cartoonists have been using for years—that can emphasize or suggest movement using a minimal number of frames.

Motion blur, which can be applied as a filter in most image-editing programs, do a great job of fooling your eye into seeing movement where none exists. Another great visual clue to indicate movement is an attitude change—skewing or slanting an image. An object that is slanting forward looks like it is moving at great speed, and an object that is slanting backward looks like it is attempting to stop. Other examples include streaked lines, which can substitute for a motion blur in many cases, or transparent trails that imply an object is moving so fast you can see it in two places simultaneously.

Using this kind of cartooning shorthand can help you to reduce frame count dramatically. For example, our motion animation uses an effect that takes only four frames to accomplish its illusion. We did this by slanting the image and applying a motion blur. The resulting file size is less than 4K. 

Luisa Simone is a contributing editor of PC Magazine.

CRIB SHEET

OPTIMIZING ANIMATIONS

Get the speed right. Set text to display longer, and decrease the delay time for motion illusions.

Crop partial frames. Don't use the entire frame when a smaller image can be cropped and positioned.

Layer frame images. Use GIF's transparency and repainting methods to cover previous frames with new ones.

Use one color palette. Eliminate local palettes in favor of a single global palette for all frames.

Use illusion techniques. Blurs, slants, and streaked lines can trick viewers' eyes into seeing motion.

Use optimization features. Noteworthy are those included within Adobe ImageReady (www.adobe.com), Alchemy Mindworks' GIF Construction Set Professional (www.mindworkshop.com), Macromedia Fireworks (www.macromedia.com), and Ulead WebRazor Pro (www.ulead.com).

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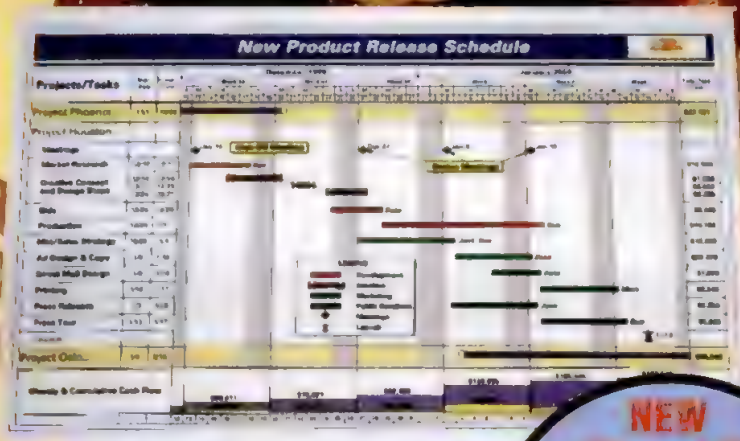
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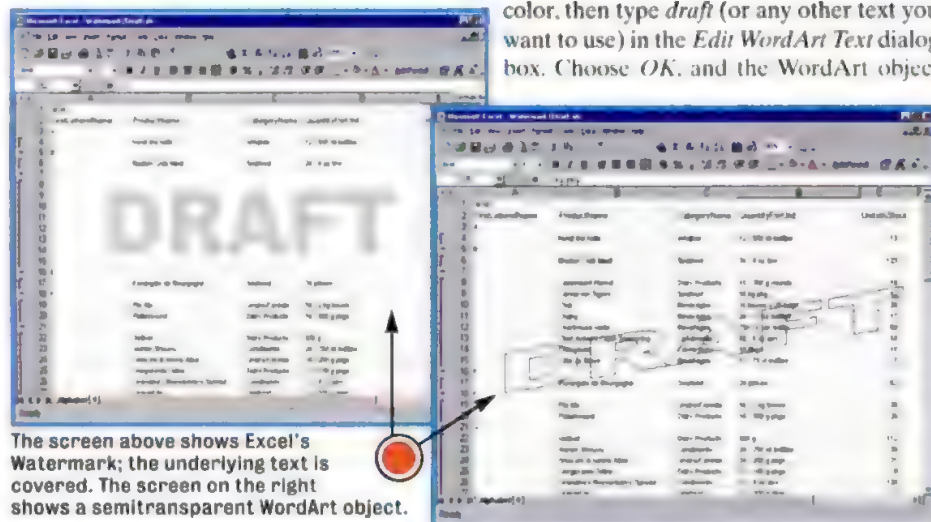
AEC
SOFTWARE

Print Watermarks in Excel

Built-in features are fine for on-screen work, but if you need to print, read on.—By M. David Stone

A watermark running across a page can announce that what you're looking at is a draft, a preliminary copy, confidential, void, or whatever else the author needs to convey about the worksheet as a whole. Microsoft Excel 97 and 2000 offer two features that should do the job, but that don't work when you print the worksheets.

You can add a picture as a background to an Excel worksheet by choosing **Format | Sheet | Background**. In either program, choose **Fill Effects | Picture** to insert, for example, an image file you created in Paint that contains the word DRAFT defined in a light gray. The word will appear on-screen and behave the way you would want a watermark to, with both the watermark and the text beneath it visible. Alas,



The screen above shows Excel's Watermark; the underlying text is covered. The screen on the right shows a semitransparent WordArt object.

this kind of background doesn't print.

The second feature that seems as though it should work as a watermark but doesn't is actually named **Watermark**. If you use the **Insert | Picture | From File** command, then select the picture and click **Format | Picture** and then the **Picture** tab, you'll find a **Color** option under **Image Control**. The **Color** choice offers a dropdown list that includes **Watermark** as one of the menu choices. Choose this, and the image will appear with a faded effect; black changes to light gray and fully saturated colors turn into pastels. Pictures inserted this way and formatted with the **Watermark** setting will print, but they won't behave as watermarks. Instead, they'll cover up any text they're inserted over, both

on-screen and on the printed page.

The good news is that there are at least two ways to add true watermarks to your spreadsheets. The first and potentially easiest choice is to add a watermark through your printer driver. Many recent drivers let you define any text watermark you like, whether the program you're printing from offers one or not. To see whether your printer offers this option, choose **File | Print**, then **Properties**, and browse through the driver looking for the feature.

A second choice is to use WordArt. If the WordArt toolbar isn't showing, choose **View | Toolbars** and click on the **WordArt** option in the list. Then click on the **Insert | WordArt** button in the toolbar to bring up the WordArt gallery. Choose one of the styles that uses only one color, then type *draft* (or any other text you want to use) in the **Edit WordArt Text** dialog box. Choose **OK**, and the WordArt object

will appear on your spreadsheet.

Select the WordArt object and choose **Format | WordArt**, then **Colors and Lines**. Set the **Fill Color** to **No Fill** to create an outline of the characters only, or set it to a light color or light shade of gray with the **Semitransparent** check box checked. Choose **OK**, then position and resize the WordArt text as necessary. You should be able to read any cell entries under the watermark text, both on-screen and in print. Note that if your worksheet prints on more than one page, you'll have to copy the watermark to each page and position it manually. **PC**

M. David Stone is a contributing editor of PC Magazine.

Nonstandard File Extensions in Word

Is there any way to keep Microsoft Word 97 from adding its own file extension to files? I would really like to make it act like other word processors—by just accepting the filename and extension that I give it, without embellishment. And when listing files, I want Word to list files with all extensions when I tell it to do so.

Joseph T. Woolley
via the Internet

The behavior you describe is typical of Windows programs in general, not just Word 97. Perhaps your other word processors were older, DOS-based applications. Windows uses the file extension to associate file types with specific programs. As you've noticed, if you save a file in Word with an extension that doesn't match the selected file type, Word will append its preferred extension. For example, if you save a Word document file as *foo.bar*, Word will change that to *foo.bar.doc*.

To force Word 97 (or any other Windows program) to save a file with a non-standard extension, just put the whole filename in double quotes. Of course, double-clicking this file won't automatically load it into Word.—Neil J. Rubenking

Importing Directory Listings

I would like to know if Excel 97 can import a directory listing. I used to do this with */File Admin Table Worksheet* in Lotus 1-2-3. This is very useful for documentation. It enables me to add a description to each filename.xls and print the listing.

Joseph De Lisio
via the Internet

Excel has no equivalent for that 1-2-3 command, but here's a workaround: Open a DOS window, go to the directory you're interested in, and type the following:

```
dir *.xls > dirname.txt
```

This will pipe the output of the DIR command to a file named *dirname.txt* (name the file whatever you want, of course). Then, back in Excel, open that file. You'll get the text-input wizard. Tell the wizard to skip over the first five lines, so that you start with the actual listing of filenames. Then just click **Finish** to import the stuff into a worksheet.—Craig Stinson

**Drive for miles, fight for parking, wait in line,
walk, walk, walk, talk, talk, talk. Repeat.**

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Changing Default Directories

Don't let Windows decide for you; put programs and data files where *you* want them.—By M. David Stone

Left to its own devices, Microsoft Windows 98 automatically uses C:\Program Files as the default directory for installing new programs and C:\My Documents as the default for data. If you've opted to have a single logical drive on your hard disk, these defaults may well be reasonable. Putting all your programs in the Program Files directory keeps them all in one place and in a hierarchical structure, and you'll always know where they are. Similarly, the My Documents directory keeps all of your data in one place—though you should create a hierarchical structure of directories under My Documents to help you locate particular files. Unfortunately, these defaults can also create problems.

For example, you may choose to create multiple logical drives to better organize your hard disk. The different drives can serve the same purpose as dividers in a file drawer—to let you separate your files into meaningful categories.

You could put Windows and other system-related files (antivirus programs, file utilities, and the like) on drive C:, data on drive D:, and application programs on drive E:. That way, when you're looking for a file, you know immediately—based on the type of file—which drive to look on. This can speed up the search,

whether you're using the *Start | Find* command or searching manually. This kind of organization also makes it easier to back up your files, since you can, for example, easily back up just your data files by backing up the one data drive.

Whatever the merits of dividing your hard disk into logical drives, Windows will still default to putting programs on drive C:. Most installation routines let you change the destination drive for the installation, but having to make the change every time you install a program is an unnecessary chore.

The problem is similar with C:\My Documents, assuming you want to put your data on a different drive or even use a more professional-sounding directory name, such as *Data*. For network administrators, the Windows preference for C:\My Documents can be more than annoying. It's not unusual to want users to store their data on a network hard disk, which ensures that the data will be backed up on schedule when the network is backed up. And for data files that more than one user needs to modify, this also ensures that there won't be different versions of the file on various local hard disks, each with a different set of modifications.

Whatever your reason for wanting to use some other name for your first-level data directory, the Windows preference for C:\My Documents means you'll have to go through the inconvenience of telling Windows programs to go to a different first-level directory than they will use by default—every time you want to save. Also, if you keep your data in a nondefault directory, then the My Documents icon on the Desktop and in Windows Explorer will not actually take you to your data. And it means that even if you delete or rename the My Documents directory, some programs will occasionally recreate the directory for you if you don't keep a careful eye out for where those programs try to save your data files.

The good news is that it's not difficult to modify Windows and change the names, locations, or both of the default directories for programs and data. The procedure involves modifying the Registry, which means it comes with the usual warnings: You need to be careful

Windows Universal Command Line

One of Microsoft Windows 98's most powerful hidden features is what I call the "universal command line." You can launch programs, open folders, go to Web sites and more. Right-click on the taskbar and select *Toolbars | Address*. Click on the *Address* label and drag the *Address* toolbar to the top of your desktop. Right-click on it and select *Always on Top*. Now, when you maximize applications, they'll expand between your *Address* bar at the top and your taskbar at the bottom.

Mazhar Memon
Albuquerque, New Mexico

The *Address* toolbar is available on any system that has the Windows Desktop Update. The WDU is installed as part of Windows 98 and comes as an option with Internet Explorer 4. At first glance, this toolbar just seems to be a portable version of the *Address* toolbar in IE. You can launch programs from it as well, however, with or without command line arguments. You can launch documents by entering their names. And of course, you can use it to go directly to any URL. The *Address* toolbar is like an always-available version of the *Run* dialog.

—Neil J. Rubenking

Fast Track to Explorer

If you want to get to Windows Explorer quickly, simply right-click on the My Computer icon and choose *Explore* from the context menu. This will open Explorer with Desktop as the root, and all disk drives shown without their folders expanded. This is convenient when you want to access a file or folder on a drive other than C:, because you don't have to close the C: drive listing or scroll down to find the other drives.

If you don't want to minimize your applications in order to see the My Computer icon, you can still get to Explorer quickly. Right-click on the *Start* button and choose *Explore* from the context menu. This opens Windows Explorer at the C:\Windows\Start Menu folder, which may mean you will have to scroll a bit to find the folder or file you want. To close the folders quickly to make it easier to find your target, simply press <Left Arrow>. (You can use <Right Arrow> to expand any folder.)—Alfred Paar

PREP WORK

Registry data is kept in two files located in the C:\Windows directory: *User.dat* and *System.dat*. Here's how to make copies of these files.

- Start Windows Explorer.
- Navigate to C:\Windows.
- Right-click on *User.dat* and select *Copy*.
- Right-click again and select *Paste*.
- A file called *Copy of User.dat* will appear at the end of Explorer's list of files.
- Repeat these steps for *System.dat*.
- Should you need to replace the original Registry files, delete the originals and rename the copies to the original filenames.

If you're using Windows 98, there's an easier way to restore Registry files. Choose *Shut Down* from the *Start* menu, then restart in MS-DOS mode. At the DOS prompt, type *scanreg /restore* to start the Registry Checker utility. Select a backup from the list presented, usually the most recent one, and press Enter.

Printing Directory Lists in Windows NT

I'm running Microsoft Windows NT 4.0 and I used your article in the August 1999 issue (www.pcmag.com/pctech/content/solutions/oe1814d.htm) to print directory lists using the Prndir.bat and Prndir.reg files but failed, getting the message Parameter format not correct xxxxxx, where xxxxxx is the directory I'm attempting to print. Also, the DIR command does not recognize the /v parameter. Without that parameter, when I enter DIR at the command line, the command works, but not from the pop-up menu.

Geoff Hummel
Hayward, California

We neglected to mention that the tip in question was specific to Windows 95 and 98. With minor modifications, however, it works fine under Windows NT. In Prndir.bat, delete the /v switch from both DIR lines, and replace the last line with `START WordPad /p %temp%\tempfile.txt`. In Prndir.reg, change all occurrences of `Command.com` to `Cmd.exe`. You will also probably need to change `C:\Windows\Prndir.bat` to the file's actual location, probably `C:\Winnt\Prndir.bat`. Now double-click Prndir.reg to install the *Print directory* and *Print directory tree* commands on the right-click menu for folders and drives. You can download Windows NT-specific versions of the two Prndir files together in a file called v18n22.zip, which is available on *PC Magazine's* Web site. —NJR

Disabling ScanDisk

Is there an easy way to tell Windows 98 not to run ScanDisk when my system reboots after a crash?

David Andrews
Marietta, Georgia

You bet there is, using the Windows 98 System Configuration Utility. The fastest way to get to this program is by clicking *Start | Run*, typing `msconfig`, and then clicking *OK*. Under the *General* tab, click the *Advanced* button. From here, you can select a range of configuration settings (but be careful with all of them), one of which is the option to disable ScanDisk after a bad shutdown. Check it, then click *OK*. —Neil Randall

not to change anything you don't mean to change, because in the worst case, you can make your system unusable. If that happens, you'll need to reinstall Windows and all your programs. But if you're comfortable with modifying the Registry, the actual procedure is straightforward.

You can change either of the default directories or you can change both. For this example, we'll assume that you want to change both. To change only one, just ignore the directions for changing the other. We'll also assume you want to change the default data directory to D: and the default program directory to E:. If you'd rather use a different drive or subdirectory, simply substitute the drive and path-name in the example.

There's one other important assumption—that you are starting with the Windows defaults for program and data directories. If you've done anything to change this in Windows itself (as opposed to setting default directories for particular programs), you'll need to return to the defaults or modify these steps to take the changes that you've made into account. Note that we've tested these

methods only with the original version of Windows 98. The steps for other versions of Windows 9x should be similar, however, if not identical.

Start by closing all programs. (This isn't strictly necessary, but it's generally a good idea in order to avoid complications.) Right-click on the *My Documents* icon, choose *Properties*, and change the *Target* to D:\ (or whatever directory you want to use as your default first-level directory for data). You may also want to right-click on the icon, choose *Rename*, and change the name to, say, *Data*.

The next step is to modify the Registry. Choose *Start | Run*, enter `Regedit` as the program to run, and choose *OK*. To change the default program directory, choose *Edit | Find*, enter `ProgramFilesDir` in the *Find what* text box, then choose *Find Next*. This should eventually bring you to `ProgramFilesDir` under the key `HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion` (which you'll see on the status bar on the bottom of the window).

The value for `ProgramFilesDir` should read

`C:\Program Files`. To change it, choose *Edit | Modify*, and type `E:\` (or whatever drive and path you want to use as the default for programs), then choose *OK*.

In Windows, certain files are shared by more than one program. These are known as *Common Files* and are kept in a location specified in the Registry. You may want these files to reside in the same place as your program files. In the same key in the Registry, you should also see the value name `CommonFilesDir` (the names are in alphabetical order). The default value for `CommonFilesDir` is `C:\Program Files\Common Files`. Change this value to `E:\Common Files` (or any other drive and path). Note that you must also manually create directories to match the directory names, if any, you enter for `ProgramFilesDir` and `CommonFilesDir`.

Keep in mind too that these changes will affect only the default directories Windows uses for installing programs in the future. They will not affect the locations of any files already on your hard disk.

To change the default data directory, return to the beginning of the Registry by clicking on *My Computer* at the top of the list in the left-hand pane. Then

search for *My Documents*. You'll generally want to change the default directory to D:\ (or whatever drive and path you prefer) wherever it appears in the Registry. This can be a little tricky, however, because you have to exercise some judgment. If you have many programs installed, you'll likely find default data directories for some of the programs as well as for Windows itself. In such cases, you may need to modify the default path using, say, `D:\WordDocs` for Microsoft Word. If you are naming directories that don't already exist, write down the names as you enter them. When you finish modifying the registry, choose *Registry | Close*. Now, create any directories you entered as defaults for particular programs and move your data to the appropriate directories. In any case, once you're done, neither Windows nor your applications programs should ever try to use *My Documents* again. ☐

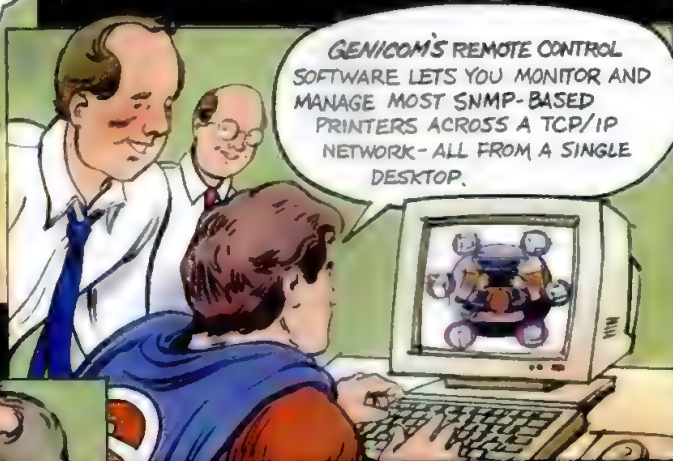
M. David Stone is a contributing editor of *PC Magazine*.



CHANGING DEFAULTS: The *Data* folder is now the root directory on drive D:, which is named *Data*.



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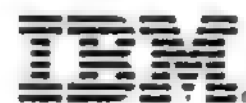
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What excites Michelle?

Michelle Pfeiffer gets a thrill from a child's first smile, first steps and first words. She also knows it's essential to interact with children by talking, singing, reading or simply hugging – especially during the crucial first three years, when their brains grow to 90% of their adult size. That's why Michelle supports "I Am Your Child" – an initiative providing important child development information to parents and caregivers. Which is exactly what you'll find at firstyears.excite.com – a resource for those who are looking for critical facts and guidance on child development. What's more, when you personalize your Excite start page at www.excite.com, Excite will donate \$2 to "I Am Your Child" – which should excite anyone who cares about kids.



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Photograph by Norman Jean Roy/Edge

DVI: An Interface for All Displays

A new standard offers the benefits of digital video while maintaining compatibility with analog monitors—*By Alfred Poor*

Analog interfaces have become standard for desktop monitors, but the increasing popularity of LCD displays brings the need for a completely digital interface. Digital-only solutions cause problems as well, both in compatibility between graphics adapters and digital displays, and in their inability to support legacy analog displays. After a few false starts by different groups and consortiums, the Digital Display Working Group (DDWG) has created the Digital Visual Interface (DVI), which has received widespread acceptance. Chances are good that your next display adapter or monitor will support this new standard.

Digital interfaces for displays are not new; the original IBM PC monochrome and color adapters relied on them. The Color Graphics Adapter (CGA) used a parallel interface with two signals for each of the three colors: red, green, and blue. One signal turned the color on and off and the other controlled the intensity—

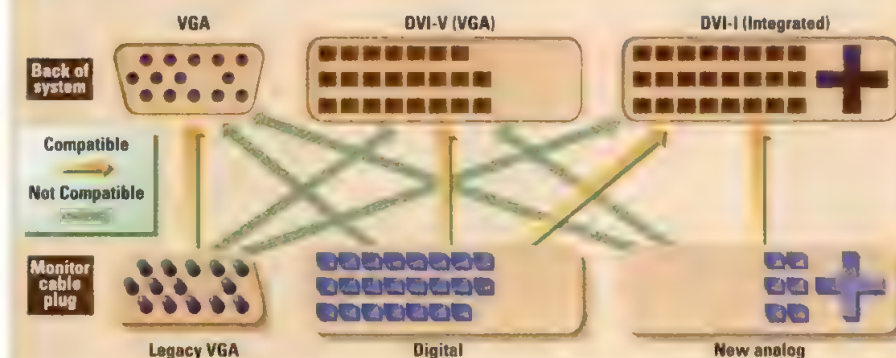
must be translated into analog signals in order to be sent to the display. This requires extra circuitry; some of the information can get lost in the conversion and transmission process, which results in lost color bits along the way.

Digital monitors—such as desktop LCDs—require an analog signal to be converted back to digital form. This adds cost to the monitor, and additional image data can be lost in the process. It is particularly difficult to translate analog data to control specific pixels on the screen; if the conversion of the sync signal is not perfect, you can get annoying pixel-jitter defects as interpolation causes the image to shift back and forth.

By contrast, a digital interface can take the digital data directly from the computer and display it pixel-for-pixel on a digital display. The result is a rock-steady image, and the screen receives every bit of the original color information.

But the problem remains: How do you get a digital interface without using dozens of wires?

DVI Connector Compatibility



normal or bright. This approach was limited to just 16 colors. If this approach were used for today's 24-bit color displays, you would need a thick cable containing more than 27 wires.

This limitation moved designers to adopt analog interfaces for displays, starting with VGA. This requires just nine wires: signal and ground for each of the three colors, the vertical and horizontal sync signals, and a main ground. Instead of the simple on/off signals of the digital interface, varying the voltages on each wire determines the brightness level for each color: A higher voltage produces a brighter color.

But analog interfaces have their limitations, too. The digital information in the computer

The answer is to switch from the parallel design of CGA and move to a high-speed serial design. The same technology advances that have made it possible to create fast serial connections such as USB and FireWire can be applied to a serial display interface.

Laptop owners may not even realize that they're already using digital interfaces. Notebook manufacturers recognized long ago that eliminating the digital-to-analog and analog-to-digital conversion steps meant reduction in component count, which in turn reduced costs. The problem is that the designs used internally in laptops don't easily make the transition to the desktop's external monitor.

Commuting Data

I have data at work that I want to bring home at night. The files are too big for a floppy disk, and a Zip drive has proven unreliable. Is there an easy way to transfer data files from the hard disk at work to my home computer over the Internet?

Terry Swindell
via the Internet

The simplest way would be to send the files to your home through e-mail. Some ISPs limit the size of e-mail messages, however; often you're limited to as little as a megabyte, so if your data won't fit on a floppy, you may not be able to e-mail it, either. If the amount of data is small enough or your ISP doesn't restrict the size of messages, you may still want to use a compression utility to create a ZIP file in order to minimize transmission time.

If the e-mail approach won't work, there are sites on the Web that let you set up private data storage areas. Some sites will also let you give other people access to the files. Some of the services are fee-based, others are free. Check out DataSaver Online Backup Service at www.datasaver.com, @Backup at <http://easy.backup.com>, and StoragePoint.Com at www.storagepoint.com for examples of this type of service.—AP

Power Presentations with Multiple Monitors

Our small school doesn't own a projector panel for computer-based presentations, but we own several monitors. Is there any way we could broadcast a presentation over these?

Marvin Royles
Lubbock, Texas

You can use a video-distribution amplifier to send a video signal from one PC to multiple monitors. For classroom, training, demonstration, and presentation applications, using a number of independent monitors enables viewers in a wide area to get a reasonable view of a display. Video-distribution amplifiers, from companies such as Extron Electronics (www.extron.com), are available in many configurations, varying in the number of input signal ports and output ports.

A typical unit has one input and six powered outputs. All you need at the training or presentation site are standard PC displays or video monitors with compatible input ports. For smooth operation, use high-quality video extension cables and be sure that you have cables long enough for your intended setting. While not inexpensive, video-distribution amplifiers are only about the size of an external modem and, combined with the cost of necessary high-quality cables, are significantly less costly and more portable than LCD projectors.

—Bruce Brown

Instant Port Expansion via USB Hubs

I want to add a second printer to my recently purchased desktop PC, but I have run out of expansion ports. I don't feel comfortable opening the computer housing, so is there any other way to attach the printer?

Bert Barrow
Kansas City, Kansas

You no longer have to open the desktop case in search of a free ISA or PCI slot; likewise, you needn't spring for an expensive notebook docking station just to hook up a scanner, digital camera, or extra printer. USB expansion hubs can often (but not always) be the answer to the search for an extra port.

Most PCs sold in the last few years include one or more USB ports. Although two years ago USB-connected peripherals were rare, today you can buy a raft of USB-enabled accessories, including printers, scanners, network connectors, speakers, mice, keyboards, cameras, and even steering wheels for racing games. If the standard one or two USB ports isn't enough, you can add USB hubs to multiply the number of ports using a daisy chain configuration. A single USB port theoretically can branch to run up to 127 peripherals. Recent products from Belkin Components (www.belkin.com), Entrega Technologies (www.entrega.com), and Xircom (www.xircom.com) add parallel and serial ports to USB hubs, to extend the range of peripherals you can connect.—BB

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MAKING THE LINK

Silicon Image, of Cupertino, California, developed one of the key technologies at work in the DVI specification. The company's PanelLink interface provides the high-speed digital connection between the graphics adapter and the display. This interface was also chosen for the Video Electronics and Standards Association's (VESA) Plug-and-Display (PnD) and Digital Flat Panel (DFP) standards. One important feature of the new DVI standard is that it works with these two precursor standards via adapter cables.

PanelLink is based on *transition-minimized differential signaling* (TMDS). The transitions convey data by switching from an off state to an on state, or vice versa. The encoding uses logic to minimize the number of transitions, which helps increase the transfer rate and improve accuracy.

The *differential* part of the technology refers to the way on and off states are signaled. In a typical single-line digital signal, voltage is raised to a high level and lowered to a low level to create the transitions that convey the data. TMDS uses a pair of signal wires, and when one goes to a high state, the other goes to a low state. If these use the same voltage change as a single line, the differential between the paired signals is twice as large. This approach transmits the data more reliably.

A single-channel PanelLink connection uses three pairs of wires: one pair each for the red, green, and blue data channels. An additional pair of wires is used for the interface clock data, and there are lines for power, ground, shielding, and other features.

A fundamental principle of physics known as the "Copper Barrier" limits the amount of data that can be squeezed through a single copper wire. The limit is about a bandwidth of 170 MHz. This is sufficient to transmit SXGA (1,200 by 1,024 pixels) images at an 85-Hz refresh rate for a CRT. LCD and other digital displays do not need high refresh rates, and at 60Hz, the DVI interface can handle UXGA (1,600 by 1,200 pixels) images. PanelLink is designed to handle current displays at these resolutions.

The developers of the DVI specification recognize that the market has always demanded ever-increasing resolutions, and the PanelLink engineers came up with a solution—use two channels. This means it will be possible for PanelLink to handle digital displays with 2,048-by-1,536 resolution and even higher.

DVI also takes advantage of other features built into existing display standards. For example, provisions are made for both the VESA

Display Data Channel (DDC) and Extended Display Identification Data (EDID) specifications, which enable the monitor, graphics adapter, and computer to communicate and automatically configure the system to support the different features available in the monitor.

PLANNING FOR CHANGE

A new digital interface for displays poses a classic "chicken and egg" problem. Graphic-adapter card manufacturers can't cut the analog cord to the millions of CRTs already on the desktops, and LCD monitor makers can't commit to a digital interface unless the graphics cards support it.

DVI has this problem covered. The interface actually supports three different types of connections. One is designed for digital-only connections, where both the card and display can

use the digital link. Another is designed for legacy use: analog on both the card and display. The third configuration supports both digital and analog on a single connection.

In fact, all three DVI options use similar connectors. These are cleverly designed so that a digital-only device cannot be plugged into an analog-only device, but both



PLUG AND DISPLAY: DVI connectors are available from Molex.

will fit into a connector that supports both types of interfaces (see diagram). The new connectors are already offered by Molex (see photo), a leading computer component manufacturer.

The digital connection uses 24 pins, sufficient for two complete PanelLink channels, plus support for the VESA DDC and EDID services. The analog connection uses six of these pins as well as five others around a plus-shaped key. A DVI-I integrated socket has a plus-shaped hole to accommodate the analog connection; a DVI-V digital-only socket does not. And the pins and sockets have gone high-tech; instead of the standard cylindrical pins found on familiar connectors, the DVI pins are flattened and twisted to create a Low Force Helix (LFH) contact. This should provide a more reliable and stable link between the cable and the connector.

Graphics-card makers are already releasing cards with both 15-pin VGA and DVI connectors, and CRT monitor manufacturers have demonstrated CRTs with digital interfaces. It looks as though the time of digital interfaces for displays has come... again. **PC**

Alfred Poor is a contributing editor of PC Magazine.

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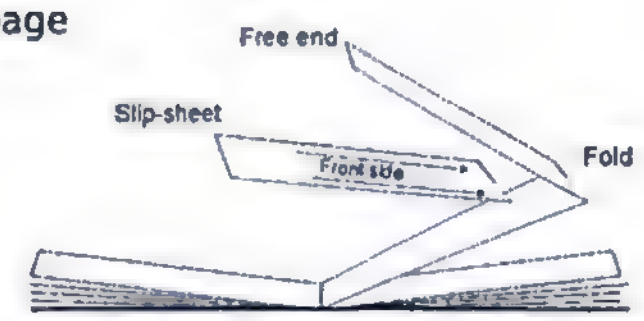
1. Open the foldout page
2. Insert this sheet with
1. Front side touching the free page
2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

Inverted Foldout slip-sheet



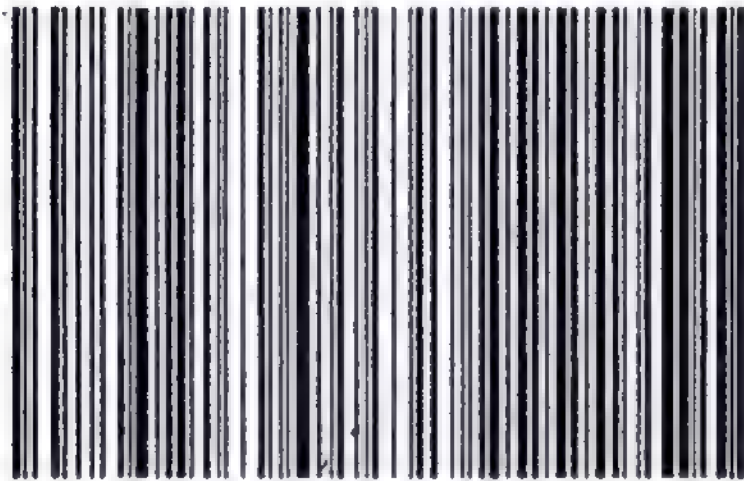
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
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4. Close the page and slip-sheet



1. Follow instructions on the other side

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Back

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Securing Your PDA

Here's how to protect your personal information from prying eyes.—By Marge Brown and Bruce Brown

Losing your PDA can be devastating, not just because of the hassle and expense of replacing the hardware but because of the lost data. Even if you haven't made any data changes since your last synchronization, the threat of someone else perusing your data can cause palpitations. But if you are willing to invest a small amount of effort, there are steps you can take to protect your data from prying eyes.

Both the 3Com Palm organizers and Windows CE PC companions have password protection features that can serve as your first line of data defense. If you've enabled password protection, anyone who tries to look at your data without entering the password is thwarted. Both device types can be configured to display contact information on the password sign-in screen so Good Samaritans can find out how to return your PDA without gaining access to any other data or applications on your device.

Third-party applications for PDAs can selectively encrypt data so that even if someone guesses the password, some of your application data is still secure. There is currently no single application for either the Palm or Windows CE platform that encrypts all data types, but if you use the operating system-supported power-on passwords in combination with third-party utilities, you'll take big steps toward protecting your data.

PROTECT YOUR PALM

Palm organizer standard security works on two levels: You can set a password to restrict access to your Palm device, and you can use the same password to protect individual memos and appointments marked *Private*. All is not lost if you forget your Palm password, however, because you can

reset your Palm organizer and restore all deleted records with the next HotSync.

The first step in protecting your Palm organizer is to synchronize your data with your desktop applications before you proceed. From the Palm's main menu, select the Security application, tap *Password*, and, when prompted, enter your password twice for verification.

You can then tap the *Turn Off and Lock Device* button to password-protect your

PDA. Try turning it on with your password the first time you lock it to familiarize yourself with the process. Once your Palm device is locked, no one can access your applications or data or perform a HotSync without entering the password. You can change your password anytime, but if you forget it, you must perform a hard reset on your Palm organizer, which deletes all entries since your last HotSync.

The Palm Security application screen also has an option to show or hide memos and appointments marked *Private* in the Memo Pad and Date Book applications. You might want to keep entries visible while working with your PIM data, and then hide selected entries once you've completed data entry. You can hide entries without using a password, but if you assign a device password, then you must reenter your password to access hidden records.

JAWS Memo, from JAWS Technologies (\$20 street, www.jawstech.com), is for those who want even tighter security on Palm organizer memos than is available with the standard memo, date-



① A single password can lock up your Palm organizer.

② In JAWS, encrypted memos are highlighted with icons.

③ With eWallet, you can store and secure vital information on electronic cards.

Ultimate Notebook Security

To protect the irreplaceable data on your notebook PC in your home, your office, or other work sites, sometimes you need to take extra security measures. While passwords can help and data encryption is an even better idea, passwords combined with biometric security give you a much higher level of protection. Biometric security systems use one or more personal characteristics, such as fingerprints, voice identification, and facial recognizers, as entry keys.

One proven biometric security device that's excellent for portable applications is the Digital Persona's U.are.U fingerprint reader (\$100 street, www.digitalpersona.com). The U.are.U reader measures 2.6 by 3.8 by 1.5 inches (HWD) and weighs 6 ounces, including its 58-inch cable. The reader connects to a USB port for both power and data and uses a 128-bit encryption system to store fingerprint data (in a format different from that used by the criminal justice system). The U.are.U system is easy to configure, reads fingerprints quickly and accurately, and is a great way to secure your PC's contents.—BB

Mobile Courtesy

The growing prevalence of mobile electronic devices has resulted in unexpected conflicts between users and nonusers, and even among users of pagers, cell phones, and portable electronics. Loud cell-phone conversations, musical alarms, incessantly beeping pagers, ringing phones, and clicking keyboards can result in a new form of audio pollution that irritates or even enrages uninvolved bystanders and colleagues.

It's universally considered bad form to take cell-phone calls while in the theater, but there's increasing resistance to listening to others' calls during meetings, in restaurants, and on public transportation. The irritation can grow if the call has a bad connection, leading the offender to yell continually, "Hello? Hello?" Emotionally charged cell-phone conversations are also inappropriate for public places; other people don't want to listen to your life.

While many pagers, cell phones, and even PDAs have vibration-alarm modes, some people insist on using an-

noying rings or other sounds. The worst case of intrusive device noise is when people choose musical alarms, played at full volume, to stand out from the cacophony of other beeps and rings. People who take notebooks and PDAs to meetings should also realize that clicking keyboards can distract and annoy others. While mobile devices are convenient and can certainly enhance productivity, users will do well to develop courteous usage habits.—BB

Hold onto Your Notebook

Notebook computers are attractive to thieves because they're lightweight, easy to conceal, and easy to resell. Whenever you travel with a notebook or other mobile device you're especially at risk, both during transit and in hotel rooms or temporary work sites. Though busy people often resist toting more gear, consider carrying along a couple of items to protect your expensive devices and irreplaceable data.

A relatively inexpensive security setup consists of a locking cable and a portable alarm. The Kensington Security System (www.kensington.com), the industry standard, involves a small slot that's built into most notebook computers and some PDAs, into which a steel cable and lock can be fitted. To use a Kensington setup, you run the cable around a large or immovable object, such as a water pipe or file cabinet handle, and then attach the lock end into the computer's security slot. Kensington's own product is the Kensington MicroSaver Security Cable, which carries a \$40 street price.

The Targus Defcon 1 (\$50 street, www.targus.com) is a pocket-size combination lock and cable with a motion detector and a 110dB alarm that will instantly sound if a secured bag or device is moved without your permission.—BB

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book, and security applets. Upon installation, JAWS Memo replaces Palm's Memo application and transfers existing memos, but does not encrypt them until you give the command. You can encrypt single memos, all memos in a category, or selected memos at both levels. You can back up JAWS Memo files to your compatible desktop PIM with each HotSync, but they can only be decrypted on your Palm organizer.

At the bottom of the JAWS new memo screen is a prompt for entering a unique password of up to 512 characters for encrypting and decrypting a memo or a memo category. You enter a password twice to encrypt a memo and once to decrypt it. JAWS uses a heavy-duty, fast-processing, 4,096-bit encryption algorithm. Your original file is overwritten with the encrypted version for tight security and to save memory. In order to more easily identify your memos in the list view, you can choose to begin encryption with characters 1 through 30 of your memos. JAWS Memo offers no exception paths; if you forget your passwords, your memos are lost forever.

You can combine JAWS Memo with Palm's Security application by labeling encrypted memos as *Private* and hiding them via the Palm password; two passwords are then required to access the files. While multilevel data security ensures confidentiality, it's better to avoid having too many PDA passwords to manage.

WINDOWS CE SECURITY

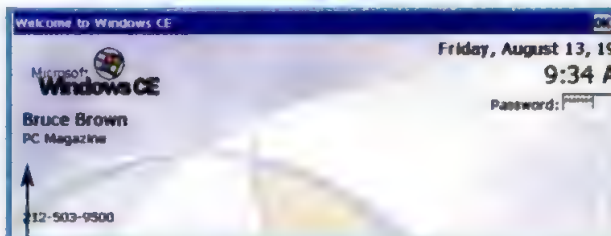
Windows CE hand-held (H/PC) and palm-size (P/PC) PDAs have a system-level password application that can be accessed via the Control Panel. The application requires password entry upon device power-up in order to advance past the first screen—which can include owner contact information to facilitate returns of lost devices. Without the password, the only way a thief can even use a protected Windows CE device is to remove the primary and backup batteries—after which the thief would have a functional device with none of your data on it.

To set the password on a Windows CE device, tap *Start | Settings | Control Panel | Password* on an H/PC or H/PR Pro (Jupiter) device or *Start | Settings | Password* on a P/PC. There's nothing complex about the Windows CE application. You're asked to enter a password twice to confirm it, and then you can click on a box to enable power-on password protection. Once you've set the password, any time you want to change the password or select (or deselect) the power-on

protection, you must reenter the password.

There are several encryption applications for Windows CE. Ilium Software's eWallet is available in different versions for H/PCs, P/PCs, and Windows 95, 98, or Windows NT 4.0 PCs (\$29.95 direct for one platform, \$10 for each additional platform; www.iliumsoft.com). eWallet uses RC4 40-bit encryption to protect data stored on specially formatted electronic cards, which are useful for storing information most people carry on cards in their wallets, such as credit card data, licenses, clothing sizes, insurance information, and contact information. eWallet includes free-form cards for entering text or ink notes as well. Developer One's CodeWallet (\$29.95 direct) is a similar program that uses 56-bit encryption; it is currently available only for Windows CE palm-size PCs.

When you work with eWallet, you create individual cards that are stored in categories.



4 When a Windows CE device with power-on password protection is turned on, the screen where the password is entered can contain owner contact information.

This extra layer of organization adds a step when you set cards up, but gives you convenient ways to protect data, since password protection is available for individual cards or for whole categories. For example, you can create a category called *personal financial data* in which all cards are automatically password-protected. A second category, called *reminders*, might not have password protection turned on for the whole category, but you can protect individual cards like gift lists, employee evaluations, or investment purchase decisions. If you find you end up with many cards in many categories, you can add another layer of organization by creating named wallets, each of which can have categories and cards. For example, you might want to create separate wallets for personal, family, work, and organizational information.

You can protect selected data on your Windows CE device with eWallet, but to protect the information stored in the standard PIM applets for contacts, tasks, and appointments, you need to rely on the device's password. 

Bruce Brown is a contributing editor of PC Magazine. Marge Brown is a frequent contributor.



PC Frustration!

Want your PC back the way it was?

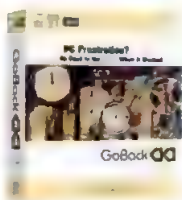
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because at 9:15 you started making major changes to a document, and at 9:50 accidentally overwrote the original (which you need), so wouldn't you like to pop back to 9:15 for a moment?

because today you downloaded something from the Internet, and now you've got a virus, so wouldn't you like to go back to yesterday?



because at this moment you're on an airplane, three hours into flight, and you did an "oops" (a big one), and now the portable crashed and won't boot, so wouldn't you like to go back five minutes?

because, and this is a real big because, you don't always have a backup when you need it, so wouldn't you like to go back anyway?



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Name	Modified Time
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GoBack Ad20 Guy In The	10/15/98 2:42:17 PM
Cdrnlnn.svs	10/15/98 2:17:45 PM

Why is this important?

because either from the everyday "oops" that occurs from user error or software problems, or virus attacks, or system crashes, or the infamous Y2K, or for reasons only a computer nerd would understand, it is inevitable that your computer will get really messed up.

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The onlookers smile. We kill the computer! How? We delete the entire Windows directory and of course, empty the Recycle Bin. We move key directories around and overwrite critical files. System trashed. Looking out at the Comdex crowd we challenge anyone to fix it. An IT person turns away in disbelief. Well, wait until you see this, guys.

We turn the PC on and off (what we all really do in a panic). GoBack fixes it all, by sending the PC back a few minutes in time.

Someone wants to see GoBack in action again. So this time we accidentally overwrite a major document, three times! Oops. No problem, with GoBack we can jump back in time and retrieve the original. Pretty cool.

In a few years it will be hard to imagine that you ever used a PC that could not go back in time. For your everyday oops, for viruses, for bad installs, and even for what might happen when the year 2000 arrives, this is what you need to have.

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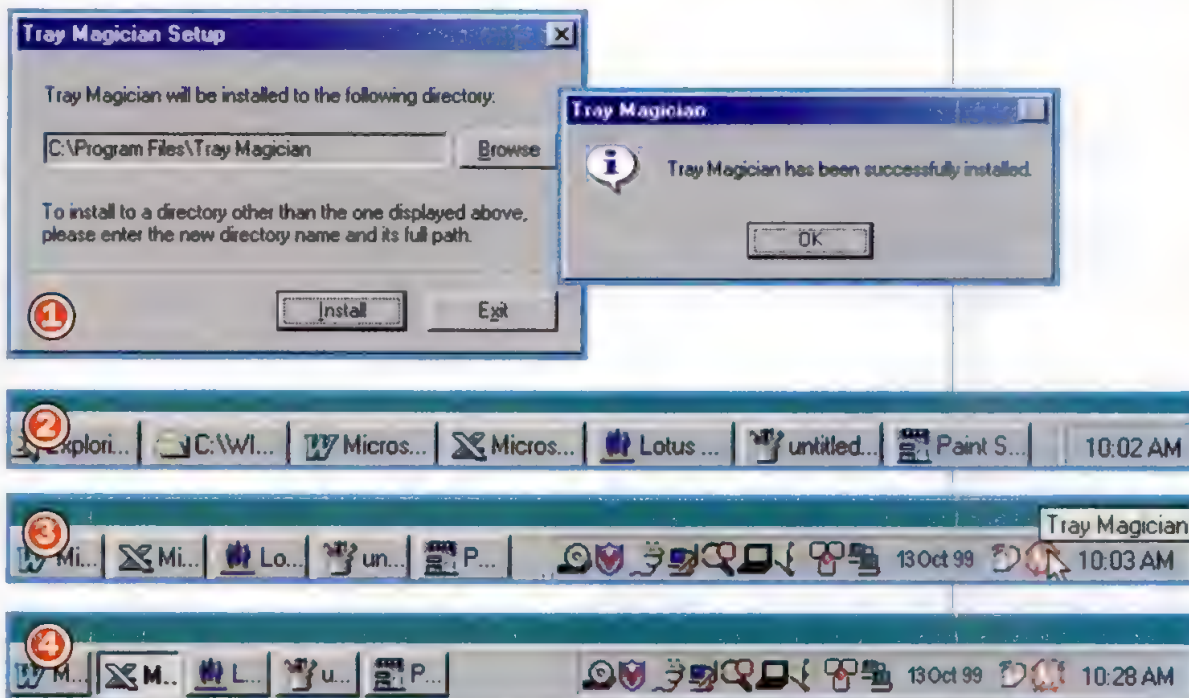
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Tray Magician Hides the System Tray

Give your task icons some room by shrinking the system tray.

—By Ignacio Alvarez



Has your system tray become so full of icons that there's no room left for your taskbar buttons? **Tray Magician** can hide the system tray icons so that you can read the buttons on your taskbar more easily. When you slide the mouse cursor over the right side of the taskbar, the tray icons reappear. You can use this utility in conjunction with another *PC Magazine* utility, *TrayManager*, that lets you put infrequently

used tray icons in a submenu.

If you need to use system tray items, a command in *Tray Magician*'s context menu will disable the program; you don't have to close it.

Tray Magician runs under Microsoft Windows 95, Windows 98, and Windows NT 4.0. An article about how to use *Tray Magician* and how it was written is available on our Web site at www.pcmag.com/utilities. A link to download the utility and its source code can also be found there. **PC**

1. Installation of *Tray Magician* is a one-step breeze.

2. *Tray Magician* hides tray icons so that taskbar buttons are more readable.

3. To make the tray reappear, simply place the mouse cursor over the edge of the taskbar where the system tray is hidden. The tray will remain visible as long as the cursor is over it.

4. If you need to keep the tray visible even when the mouse cursor isn't over it, you can temporarily disable *Tray Magician* with a command on the utility's context menu.

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Via Mail: You can request utilities by fax at 978-772-7133 or write to *PC Magazine Utilities*, c/o Image Software Services, 67 Buena Vista St., Ayer, MA 01432-5030. There is a limit of six disks per month.

Support: To obtain help for *PC Magazine*'s free utilities, visit our online discussion area on the Internet (www.pcmag.com/utilities/support.html).

Ignacio Alvarez is a software developer based in Nogales, Sonora, Mexico. Sheryl Canter is the editor of the Utilities column and a contributing editor of PC Magazine.

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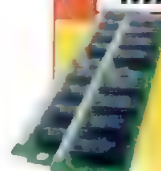
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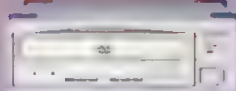
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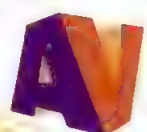


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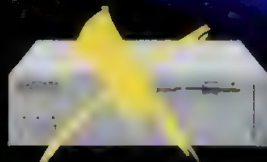
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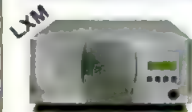
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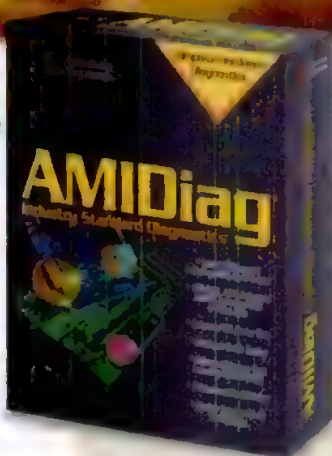
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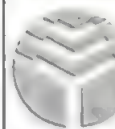
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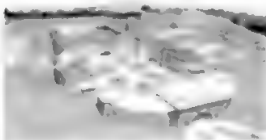
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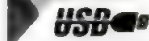
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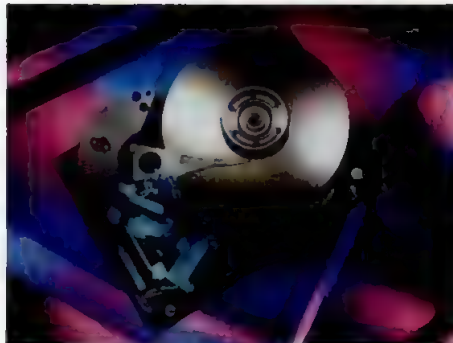
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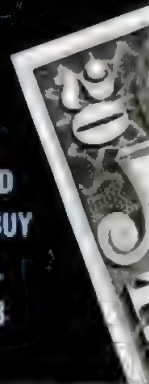


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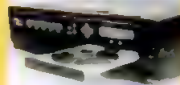


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THE HOME SIDE OF COMPUTING



Holiday Gift Guide

PC Magazine's 80 favorite software titles, games, gadgets, and gift-giving sites.

By Michael E. Ryan

With holidays once again upon us, you probably have to come up with some great gift ideas in one heck of a hurry. Not to fear. We've explored mountains of software and spent hours with the latest hardware accessories and gadgets to bring you a list of the best gift ideas for family and friends.

The 60 products in this story are divided into four categories: Kids' Software, Games, Reference & Home, and Gadgets & Hardware. The Kids' Software category is subdivided into two broad age groups—9 and under and 10 and up—though you will see some overlap. You'll also find that our Gadgets & Hardware section isn't limited to children's products; after all, no one ever said that all toys have to be child's play. And we've included 20 Web sites that are chock full of

holiday gifts and ideas you can get online.

For this roundup, we found the best and most promising new products scheduled to hit store shelves by no later than mid-December. This means that for

many of the products listed here, we based our evaluation on prerelease (or beta) software. Though we're confident that the majority of these products will meet their scheduled ship dates, some will inevitably be delayed and not quite make it into stores in time for the holidays.

This year's holiday gift list includes a few software titles cited in our Top 100 CDs story (October 5, 1999)—products we liked so much, we simply had to include them here, too. Check out that story for even more gift suggestions.

KIDS' SOFTWARE
(Ages 9 and Under)
228

KIDS' SOFTWARE
(Ages 10 and Up)
227

GAMES
228

HOME & REFERENCE
232

GADGETS & HARDWARE
234

CLICK AND ORDER
238

KIDS' SOFTWARE

AGES 9 AND UNDER

Backyard Football (\$19.99 list; ages 5-10; Humongous Entertainment, 800-499-8386, www.humongous.com). Featuring junior versions of NFL stars Steve Young, John Elway, and Jerry Rice, this game lets kids pick players for their own teams and then compete for the neighborhood



championship. Other titles in this excellent series include Backyard Baseball and Backyard Soccer (\$19.99 each).

Barbie Super Sports (\$34.99 list; ages 5 and up; Mattel Media, 888-628-8359, www.mattel.com/home).

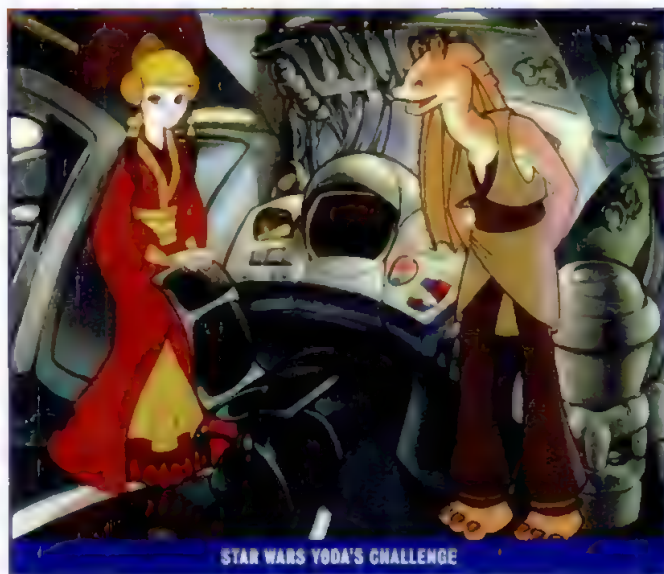
Extreme sports is the theme as players take Barbie in-line skating or snowboarding in races, obstacle courses, and stunt competitions. Wins translate into points that can be used to get cooler equipment and more stunts.

Blue's Treasure Hunt (\$29.99 list; ages 3-6; Humongous Entertainment, 800-499-8386, www.humongous.com). Steve, Blue, and a new character named Treasure Bug lead players on a search for the keys

to the Land of Great Discovery. This wonderfully animated title captures the true look and feel of the TV show while offering a wealth of fun and creative activities for preschoolers.

Disney's Winnie The Pooh Toddler (\$19.99 list; ages 18

months-3 years; Disney Interactive, 800-328-0368, www.disneyinteractive.com). Great animation and a healthy assortment of activities make this Disney title an excellent choice for kids ready to take their first crack at computing. Number and letter recognition, memory



skills, shapes, and even music appreciation are just a few of the educational concepts kids will discover with this game.

Dr. Seuss Preschool (\$20 street; ages 2-5; Broderbund Software/The Learning Company, 800-548-1798; www.shoptlc.com). Starring Horton the elephant, this title features more than 250 lessons that help kids develop basic math, reading, memory, and listening skills, among others. The excellent animation and witty banter help make the lessons fun.

Freddi Fish 4: The Case of The Hogfish Rustlers of Briny Gulch (\$19.99 list; ages 3-8; Humongous Entertainment, 800-499-8386, www.humongous.com). One of Humongous's most beloved and recognizable characters, Freddi Fish, returns to solve another puzzling mystery under the sea. Along with her pal Luther, Freddi must explore and interact with other characters to find the missing hogfish.

Math Blaster for 1st Grade (\$30 street; ages 5-7; Knowledge Adventure, 800-542-4240, www.blasternaut.com). Another great educational title in the long-running Blaster series, Math Blaster for 1st Grade helps kids get a handle on

whole numbers, number patterns, telling time, and a host of other math skills. This excellent series includes Reading and Math Blaster titles for grades 1 through 5, along with a kindergarten reading product.

My First Amazing Science Explorer (\$26.95 list; ages 6-10; DK Interactive Learning, 800-937-5557, www.dk.com). Using creative animated characters to explain scientific concepts and to help make the learning process fun, this title helps kids figure out an array of science basics. Similar titles from DK Interactive, also recommended, include My First Amazing History Explorer and My First Atlas.

Noddy: Playtime in Toyland (\$30 street; ages 4-6; Knowledge Adventure, 800-542-4240, www.knowledgeadventure.com). Traveling to Toyland to visit Noddy, kids take part in 12 arcade-style activities that teach them basic spelling, matching, and math skills. Based on the popular TV series, this title should both delight and inform young fans of the show.

SPY Fox 2: Some Assembly Required (\$24.99 list; ages 5-10; Humongous Entertainment, 800-499-8386, www.humongous.com). The



evil Napoleon LeRoach has created a dogbot and unleashed it without an off switch. To save the world, kids must help secret agent SPY Fox find the off switch, which is hidden somewhere in the World's Fair. Great animation and tons of humor make this a must-have title for would-be sleuths.

Star Wars Yoda's Challenge (\$29.95 list; ages 6 and up; Lucas Learning, 888-532-4263, www.lucaslearning.com). Helping Yoda and the Jedi Council, players engage in a variety of activities that promote math, music appreciation, and reading skills. Along with Yoda, this game includes a number of familiar faces from Episode I, including Jar Jar Binks, C3PO, and Queen Amidala.



STAR WARS PIT DROIDS

AGES 10 AND UP

Animaniacs: A Gigantic Adventure (\$19.95 list; ages 8 and up; SouthPeak Interactive, 800-774-6183, www.southpeak.com). Playing as Yakko, Wakko, and Dot, kids fight against the plot of the evil Thaddeus J. Plotz. As they travel the Warner Brothers Studios' back lot, players take part in arcade games and plenty of slapstick cartoon fun to prevent Plotz from destroying old Animaniacs films.

Carmen Sandiego's ThinkQuick Challenge (\$29.95 list; ages 8-12; The Learning Company, 800-227-5609, www.learningco.com). The world's greatest thief is at it again.

This time she's stealing the world's knowledge. To stop her, players take on quiz-style challenges in math, science, art, geography, and music.

Disney's Villains' Revenge (\$29.99 list; ages 7 and up; Disney Interactive, 800-328-0368, www.disneyinteractive.com). Guided by Jiminy Cricket, players take on four of Disney's most dastardly villains—Captain Hook, the Queen of Hearts, the Evil Queen, and the Ringmaster—in arcade-style challenges. Excellent graphics highlight this enjoyable title.

Dr. Brain Action Reaction (\$20 street; ages 10 and up; Knowledge Adventure, 800-542-4240, www.knowledgeadventure.com). Based on the high-powered Unreal graphics engine, this title depicts the adventures of Dr. Brain in stunning 3-D. Traveling the game's 45 levels, players must tackle a series of challenging puzzles using their minds instead of their trigger fingers.

Math Advantage 2000 High School (\$39.99 list; ages 13

and up; Encore Software, 310-342-0600, www.encoresoftware.com). Cramming eight subjects onto seven CDs, this exhaustive study aid can help students master math concepts through animated lessons, 3-D learning games, and more than 3,000 sample problems. Starting with pre-algebra and working its way up through calculus and statistics, this great package covers it all.

The Princeton Review: Inside the SAT, ACT & PSAT Deluxe 2000 (\$39.95 list; ages 14-18; The Learning Company, 800-227-5609, www.learningco.com). This is an excellent reference and tutor for any high school student looking to improve college admission test



DISNEY'S VILLAINS' REVENGE

scores. The package's full prep classes, sample tests, and score analysis are bolstered by admissions information on 1,500 colleges, plus financial aid data.

Star Wars Episode I: The Gungan Frontier (\$29.95 list; ages 8 and up; Lucas Learning, 888-532-4263, www.lucaslearning.com). The Gungans want to colonize the moon of Naboo and players get to help them do it. By populating the moon with plant and animal life and then monitoring how the ecosystem evolves,

kids strive to achieve balance between the Gungans and nature.

Star Wars Pit Droids (\$29.95 list; ages 8 and up; Lucas Learning, 888-532-4263, www.lucaslearning.com). This well-animated, entertaining game challenges players to guide hapless pit droids from their transport ship to the pod-racing arena. Using a limited supply of arrows, kids plot a path for the droids to follow. The game offers over 300 puzzles and three difficulty settings. You can also create your puzzles and swap them with other players.



DR. BRAIN ACTION REACTION

AFTER HOURS

GAMES

Age of Empires II (\$40 street; Microsoft Corp., 800-426-9400, www.microsoft.com). Sequel to one of the most popular strategy games ever, Age of Empires II challenges players to take charge of 13 historical civilizations and lead them through the Middle Ages. Research new technologies, build armies and

negotiate with your foes to thrive—and survive.

Asheron's Call (\$45 street plus \$10/month; Microsoft Corp., 800-426-9400, www.microsoft.com). An online-only role-playing game set in a stunning 3-D world, Asheron's Call is so addictive that it may spell the end of your free time. Form alliances with your fellow players and embark on dangerous quests to gain wealth and power.

Descent 3 (\$40 street; Interplay Productions, 800-468-3775, www.interplay.com). The latest entry in the ever-popular Descent series, this game pits players against 30 types of cunning robot adversaries.



Fly through underground tunnels and across desolate planets as you attempt to eradicate the automaton menace. You'll find great multiplayer action in this game as well.

slash your way through a variety of monsters as you seek to thwart a demon's plans to destroy the world.

Diablo II (\$50 street; Blizzard Entertainment, 800-953-7669, www.blizzard.com). Eagerly anticipated by most hard-core game players, Diablo II delivers even more of the fast-paced fantasy action that made its predecessor so popular. Hack and

Freespace 2 (\$45 street; Interplay Productions, 800-468-3775, www.interplay.com). Bigger and even more graphically stunning than the original Freespace, this title is the 3-D space combat game of the year. Dangerous nebulae, massive alien capital ships, and swarms of alien fighters all threaten your survival in this one.



Battlezone II (\$45 street; Activision Inc., 310-255-2000, www.activision.com). A mysterious alien force is attacking our solar system, and it's up to you to defeat them. Lead your troops over a variety of lush 3-D landscapes, fighting off the invaders in this real-time strategy game.



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Homeworld (\$45 street; Sierra Home, 800-757-7707, www.sierrahome.com). Leading your tiny fleet of spacecraft across the universe, you must fight off hostile forces while searching for the homeworld of your people. Excellent 3-D graphics and a unique style of real-time strategy set this game apart from the crowd.

Jack Nicklaus 6: Golden Bear Challenge (\$30 street; Activision Inc., 310-255-2000, www.activision.com).



.com). Looking for the best overall golf game currently available? This is it. With great graphics, a custom-course-design utility and game play that caters to players of all skill levels, Jack Nicklaus 6 is truly in a class by itself.

NHL 2000 (\$35 street; EA Sports, 800-245-4525, www.easports.com). The best game on ice gets even better this year. NHL 2000 offers smarter computer players, more play options (such as a fantasy

draft) and more realistic on-ice action than any other simulation hockey game. The graphics are phenomenal too, and you can even import your own face into the game.

Pandora's Box (\$20 street; Micro-



NHL 2000

soft Corp., 800-426-9400, www.microsoft.com). Designed by Tetris creator Alexey Pajitnov, Pandora's Box is an elegant and addictive game that challenges players to solve 10 different types—and more than 350 variations—of puzzles. Most of these visual brain-teasers seem simple at first, but with numerous variations on each type, this game will have you guessing for hours at a time.

Pro Pinball: Big Race USA (\$20 street; Empire Interactive, 800-216-9706, www.empire-us.com). The best pinball game ever developed for the PC, this simple but addictive game should appeal to any fan of silver ball action. The beautifully rendered and challenging table will make you forget that you're not standing in front of a real arcade machine.

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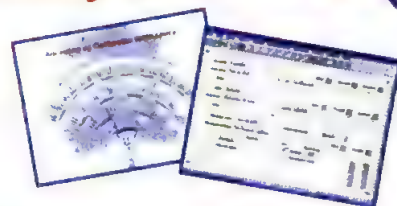
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Quake III Arena (\$45 street; Activision Inc., 310-255-2000, www.activision.com). The latest variation of the first-person shooter classic, Arena emphasizes gladiator-style armed combat in a series of neo-goth-

ic settings. Top-notch 3-D graphics and multiplayer thrills are key features in this game. Even solo play is patterned after an online death match.

SimCity 3000 (\$50 street; ages 6 and up; Electronic Arts, 800-245-4525, www.simcity.com). Design and control an entire city with SimCity 3000. Unlike its predecessor, SimCity 2000, SimCity 3000 has wonderful 3-D technology for detailed views of your city's buildings, roads, and more. Also new are farms, waste management and interaction with the online site www.simcity.com.

Tom Clancy's Rainbow Six: Rogue Spear (\$49.95 list; Red Storm En-

tertainment, 919-460-1776, www.redstorm.com). Following up the game that inspired Tom Clancy's *Rainbow Six* novel, *Rogue Spear* puts you in command of the world's foremost counter-terrorism military force. Plan your missions carefully, then lead your troops into a series of first-person 3-D battles.

Vampire: The Masquerade—Redemption (\$45 street; Activision Inc., 310-255-2000, www.activision.com). Playing as a good vampire, you must combat the machinations of an evil, rival vampire clan in a story spanning hundreds of years. You even have to feed off of innocent townsfolk to stay alive in this 3-D role-playing game.



Worms Armageddon (\$30 street; MicroProse/Hasbro Interactive, 800-400-1352, www.hasbroidinteractive.com). Plenty of good, clean fun and armies of heavily armed worms make this hilarious game a big hit for players of all ages. Move your worm warriors, choose one of 60 wacky weapons, and aim carefully to eliminate your foe before you get wiped out yourself.

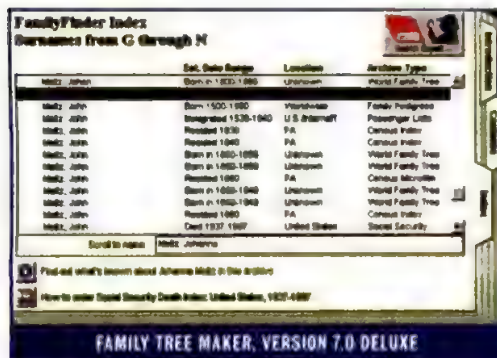


HOME & REFERENCE

The Complete National Geographic: 110 Years of National Geographic Magazine (\$99.95 list; Broderbund, 800-521-6263, www.broderbund.com). An updated version of the excellent title we included in last year's gift guide and this year's top 100 CDs, this comprehensive collection includes every page of every *National Geographic* magazine ever printed—including the ads. This huge compilation is available on 31 CDs or 4 DVDs.

Encarta Reference Suite 2000 (\$99.95 list; Microsoft Corp., 800-426-9400, www.microsoft.com). Featuring an encyclopedia, a world atlas, a new English dictionary, and extensive online content, Encarta is an impressive collection of reference material. Offering the same user-friendly interface and accessibility of past versions, this year's Encarta remains a top choice for students and families.

Encyclopædia Britannica 1999 (\$99.95 list or free as online service; Encyclopædia Britannica Inc., 800-747-8513, www.britannica.com). With over 73,000 articles, Encyclopædia Britan-



ica 1999 remains the most in-depth and exhaustive multimedia encyclopedia. While not quite as intuitive as the Encarta products, this title offers much better multimedia support than previous versions. A



high-end online site, www.eb.com, is \$5 per month.

mend it nonetheless.

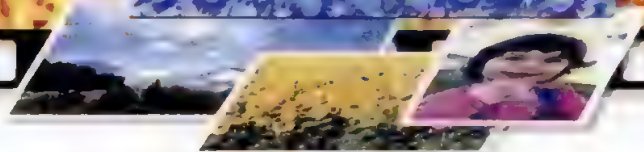
Family Tree Maker, Version 7.0 Deluxe (\$89.99 list; Broderbund Software, 800-521-6263, www.broderbund.com). The most popular and powerful genealogy program available, Family Tree Maker offers everything you need to research and chart your family heritage. This 20-CD mammoth would be a lot more appealing on DVD, but we recom-

Totally MAD (\$69.95 list; Broderbund Software/The Learning Company, 800-521-6263, www.shoptic.com). Similar to the *National Geographic* compilation, only a lot funnier and more irreverent, this seven-CD collection contains 20,000 pages of humor from over 500 issues of *MAD* magazine. *Totally MAD* is the only gift in our guide that comes with a roll of toilet paper.

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GADGETS & HARDWARE

Cambridge SoundWorks Desktop Theater 5.1 DTT2500 (\$299.95 direct; Cambridge SoundWorks, 800-367-4434, www.cambridgesoundworks.com). Gamers who want great surround



▲ DIAMOND RIO 500

sound should check out this five-channel (plus subwoofer) system. The Dolby Digital decoder means the DTT2500 could double as a home-theater speaker system.

C-Pen 200 (\$199 direct; C Technologies, 877-275-2736, www.cpen.com). This fascinating, six-language, Swedish hand-held device looks like a high-lighter on steroids and scans lines of text, displays them on a small LCD screen, stores them in folders and files, then transfers them to your laptop via the infrared port. The C-Pen also works as a handwriting OCR pen, translating letter by letter as you write.



▲ INTEL PC CAMERA PROPACK

Diamond Rio 500 (\$269.95 list; Diamond Multimedia, 800-468-5846, www.diamondmm.com). Storing up to 2 hours of MP3 digital music with support for Audible's spoken-word content, this is the latest from the company that started the Walkman-meets-MP3 revolution.

Intel PC Camera ProPack (\$129.99 list; Intel Corp., 800-523-9009, www.intel.com). The Intel PC Camera ProPack lets you make video phone calls, capture snapshots, record videos, create Web pages, shoot your own movies, and play games with animated on-screen objects.

Intel Play QX3 Computer Microscope (\$99.99 list; Intel Corp., 800-523-9009, www.intel.com). One of the finest educational toys we've seen, the Intel Play QX3 is a colorful microscope that connects to your PC via USB cable. Designed jointly with Mattel, the QX3 allows you to zoom in on objects (10X, 60X, 200X), view them on your monitor, or save them to disk.

JumpStart and Blaster Learning Games (\$15 street; Knowledge Adventure, 800-542-4240, www.knowledgeadventure.com). Inspired by the Knowledge Adventure software titles, these hand-held electronic games help kids master basic reading, spelling, and math.

Lego MindStorms Droid Developer Kit (\$100 list; Lego, 800-510-5773, www.lego.com). *Star Wars* robot fans can build their own R2D2s with this slick robotics kit from Lego. An animated software training manual guides kids through the process of constructing and operating droids. These droids move, react to light, and play interactive games.

Lego MindStorms Robotics Discovery Set (\$149 list, Lego, 800-510-5773; www.lego.com). This creative

set lets kids build motorized, programmable toys that can react to light, touch, or a series of commands—all without a computer.

Little Tikes Cozy Coupe Mouse (\$19.99 list; KB Gear Interactive, 612-941-1905, www.kbgear.com). Now kids can use a computer mouse that looks just like their favorite little car. It's bright, colorful, and rugged.

Logitech WingMan Force Feedback Mouse (\$75 street; Logitech, 510-795-8500, www.logitech.com). Here's the perfect gift for the game player who thinks he has everything. This USB mouse can add a little rumble to games that support force-feedback. The WingMan offers a limited range of motion but is a pretty slick game controller otherwise.

Matchbox Construction Zone CAT Controller (\$40 street; Mattel Media, 888-628-8359, www.mattelmedia.com). Bundled with a slick CD-ROM construction game from Mattel Media, this colorful device sits atop a standard keyboard and lets kids control big machines like tractors, excavators, and combines.

Microsoft IntelliMouse Explorer (\$65 street; Microsoft Corp., 800-426-9400, www.microsoft.com). IntelliMouse Explorer employs an optical transceiver that takes 1,500 "snapshots" per second of your desk surface and uses tiny irregularities as reference points. The result: accuracy doesn't degrade, unlike with mechanical-ball mice affected by dirt buildup. Kids will love the red glow when IntelliMouse runs, but the unit will feel big in small hands.

Microsoft Internet Keyboard (\$29.95 list; Microsoft Corp.,

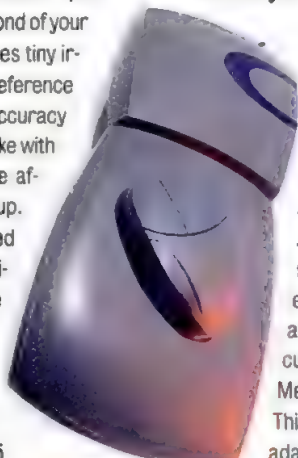


▲ INTEL PLAY QX3 MICROSCOPE

800-426-9400, www.microsoft.com). This nicely designed keyboard includes customizable hotkeys that can simplify e-mail and Web access. Dedicated sleep and calculator buttons are also included, as well as a detachable wrist rest.

Modem upgrade: DSL or cable modem. Serious Web surfers should investigate cable modem or DSL (digital subscriber line) services from cable or phone providers. Order the service for your favorite "mouse potato"—you pay \$40 to \$50 a month for always-on service. Check www.getspeed.com to see what options are available in your area.

New Media Mobile Gamer (\$55 street; New Media Technology Corp., 800-227-3748, www.newmediatechcorp.com). If you're the sort of business traveler for whom Hearts and FreeCell just don't cut it, get the New Media Mobile Gamer. This PC Card joystick adapter lets you plug



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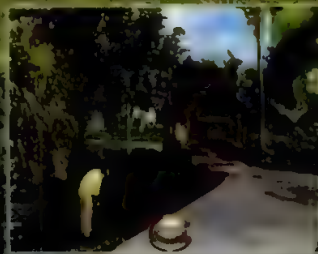
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AFTER HOURS



▲ MICROSOFT INTERNET KEYBOARD

your favorite joystick or game controller into your laptop PC.

ReplayTV (Replay Networks Inc., 877-737-5298, www.replaytv.com) or **TiVo** (TiVo Inc., 877-367-8486, www.tivo.com). These personal video recorders are basically big hard disks and MPEG-2 encoders (selling for \$500 to \$1,500) that cache or record TV shows better and more intelligently than a VCR. Rivals ReplayTV and TiVo are more alike

than different; Replay has a commercial-skip button, and TiVo has like and dislike buttons that guide future viewing choices.

Sega Dreamcast (\$199 list; Sega of America Inc., 800-872-7342, www.dreamcast.com). The recently launched Sega

Dreamcast video game console provides unprecedented 3-D graphics quality. The Dreamcast also lets video game players hook into the Web.

3Com Palm Vx (\$450 street; 3Com Corp., 800-342-5877, www.palm.com). The coolest of the palm-size PDAs is the



▲ MATCHBOX CAT CONTROLLER

thinnest: the Palm Vx with 8MB RAM. At 0.4 inches thick, Palm Vx fits neatly in a suit coat or shirt pocket yet holds thousands of phone numbers and appointments.

3-D accelerator (prices vary). Serious game-players should look for a graphics adapter based on the widely supported 3dfx Voodoo3 or nVidia TNT2 Ultra chip sets for \$100 to \$200. While support is only beginning, for raw speed consider adapters based on the new, 23-million transistor nVidia GeForce 256 chip sets—about \$300.

3dfx Hammer-Head FX (\$40 street; 3Dfx, 800-367-3339, www.3dfx.com). Game players have had

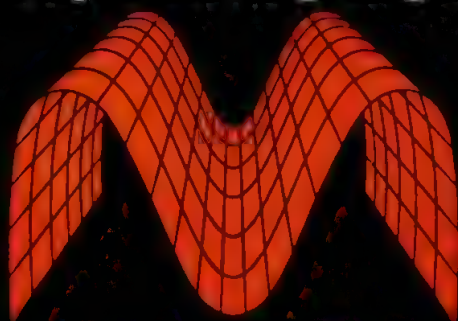


▲ 3DFX HAMMERHEAD FX

vibrating controllers for the past year. Now PC game fans have a force-feed-back game pad. This oversized pad provides great tactile feedback.

X10 ActiveHome Deluxe Kit (\$99.95 list; X10, 800-675-3044; www.x10.com). This 12-piece set of home automation tools lets you connect lights and appliances to your PC, which can then control when they turn on and off. Other companies offer similar kits.

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AFTER HOURS

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E-CARDS

www.bluemountain.com Blue Mountain Arts offers a card for every occasion, holiday, and religion. As with Hallmark and 3DGreetings, you e-mail your card to the recipient.

www.hallmark.com Hallmark offers online versions of select cards. The site lets you set reminders for birthdays, anniversaries, and other events that require just the right sentiment.

www.paperstudio.com Download PaperStudio.com's high-quality cards and print them yourself. Unless you're handy with scissors, you'll want to buy the matching cards and envelopes, typically ten for \$15.

www.3dgreetings.com 3DGreetings.com has the most dynamic holiday greeting cards out there. The site lets you customize them with your own photos, images, and sounds.

SHOPPING MALL SITES

www.amazon.com The mother of all shopping sites now has toys, games, videos, and electronics. Clearly designed and informative, Amazon.com has received *PC Magazine* Editors' Choice and Readers' Choice awards.

www.bravogifts.com Focused on business gift-giving, Bravo Gifts features a cool guide to what's appropriate in 21 different countries. (Watch out for green hats when you're in Hong Kong.)

www.productopia.com Expert reviews pare down your choices to just the right gift. Productopia is a great, easy-to-sift-through resource.



www.shopforchange.com Whether you're buying CDs, flowers, games, or toys, ShopForChange.com donates 5 percent of the price to nonprofit organizations.

TOYS FOR KIDS

www.boozlestoybox.com Bring out the imagination in your child. Boozle's Toy Box has a great selection of toys that are designed to make your children think, not just to keep them entertained.

www.rumpustoy.com Order from Rumpus, the company that brought you Gus Gutz, and the shipping box converts to a toy; the cornstarch packing peanuts can be stuck to any surface, including foreheads.

TOYS FOR GROWN-UPS

www.chipshot.com Looking for golf gear? Weekly specials help you find something nice, and you can't go wrong with new balls or a sand wedge.

www.cooking.com Offering a nice collection of knick-knacks and kitchen gadgets for that sous-chef in your life, Cooking.com also has a holiday

gift guide that will help you find a memorable gift.

www.hobbies.com Your hobbyist friend knows exactly what he wants, but do you? Check eHobbies.com to see suggestions for model train lovers, rocketry fans, and others.

LOVE ME, LOVE MY PET

www.petopia.com If you're buying a last-minute gift for Fido or Fluffy, check out Petopia.com; the site promises 24-hour order fulfillment, and it has a

huge selection.

www.pets.com This site offers a clever pet-lifestyles guide, which can help you pick just the right gift, whether you have an urban pet or a gadget pet.

www.petstore.com A partnership with the American Animal Hospital Association tells you this site cares about pets. And they'll deliver live fish to your door—literally flying fish!

MORE DEALS

www.clickthebutton.com Before making that final click to complete your online transaction, press the red button this site installs in your System Tray. You'll be whisked to a handy Web page comparing prices at dozens of vendors.

www.coolsavings.com Coolsavings.com offers coupons and special offers at popular stores.

www.ebates.com Get back a percentage of your purchases when you order through ebates.com.

www.giftcertificates.com Let fussy friends choose their own gifts. Select from a wide variety of merchants. —Jeremy A. Kaplan **PC**

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NOTHING **Wrecks** A GOOD PARTY...



...FASTER THAN A

bad Host

When It Comes to Your Web Site, You Have Two Choices:

- Acquire the hardware, software, and expertise necessary to operate it yourself,
- Or
- Hire a Web hosting service that will do a better job than you can.

Trouble is, the World Wide Web's still something of a new frontier, and not all Web hosting services are created equal. Some hosts just can't keep their act together, even though they try to razzle-dazzle you up front, when you're deciding who to hire.

If your business depends on your Web site — even if you've decided to keep your site minimalistic — then your business depends on your Web hosting service. After all, if visitors can't access your Web site, it just doesn't matter how great it looks or how valuable your offerings might be.

Bottom line: you simply can't afford a hosting company that can't do a good job.

But unless you've got some solid technical experience and unless you have a lot of detailed information about each Web hosting company you're considering, it's tough to know how to choose the Web hosting service that's best for you.

Solution: The Web Host Guild

Dedicated to raising the standards of the Web hosting industry and protecting consumers, the Web Host Guild has established a set of objective, verifiable criteria for certifying Web host companies.

By choosing a Web Host Guild member to serve as your

Web hosting service, you can avoid the pitfalls that claim the unwary, such as inadequate infrastructure, poor maintenance, unresponsive technical support, overcharging, or an inability to scale up as your needs grow.

To become a WHG member, a Web hosting company must pass a strenuous certification evaluation. Once membership is achieved, a hosting company is entitled to display the Guild Seal on its site and is included in the Guild's searchable member directory. It doesn't end there: WHG members must continue meeting the Guild's stringent certification criteria to maintain their membership and are reviewed every quarter to ensure standards continue to be met.

The Web Host Guild's only function is to certify Web hosts, so WHG efforts to offer objective certification to hosting companies can stay focused and undistracted by such things as awards programs or attempts to list all hosting companies. The Guild's ability to maintain a clear set of criteria for certification means that you have a respected, honest and credible source of information about Web hosting company capabilities.

What It Takes: Web Host Guild Certification

Web Host Guild members must meet many criteria to achieve certification and pass a set of rigorous tests designed to benchmark not only the technical side of hosting but also customer service and the availability of technical help.

Key requirements include:

- Access to a human being for round-the-clock technical support,
- A minimum of eight hours a day of direct telephone support,
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These criteria actually are only part of a much longer list (for a look visit the Guild's Web site at whg.org) that, in total, assures Web hosting customers of members' ability to deliver reliable service and support. In addition, the Guild uses the services of member NetMechanic to regularly audit the performance of all members. And Guild employees pose as potential customers and call members to verify the quality of customer service and knowledge-level of help desk staff.

Once a Web hosting service provider has passed the Guild's tests, it must then be voted into membership by the Guild's board of directors and agree to quarterly performance audits.

What You Get: Reliability, Support, and Speed

When you choose a Web hosting service certified by the Web Host Guild, your Web site is in the hands of a company that delivers on the Guild's ambitious motto, "Reliability, Support, and Speed."

This assurance, in turn, enables you to focus your efforts on your business and how it's reflected on your Web site instead of worrying about whether anybody can access it.

When your Web hosting company displays the Web Host Guild Seal on its site and in its literature, you can be confident of the quality of that company's ability to host your Web site, both now and in the future.

The Web Host Guild

was founded in July 1998 by twelve Webmasters to protect consumers from unscrupulous hosts and to help identify the growing number of honest, reliable Web hosting services. The Guild is provided over by a nine-member Board of Directors chosen with confidence including new Guild members.



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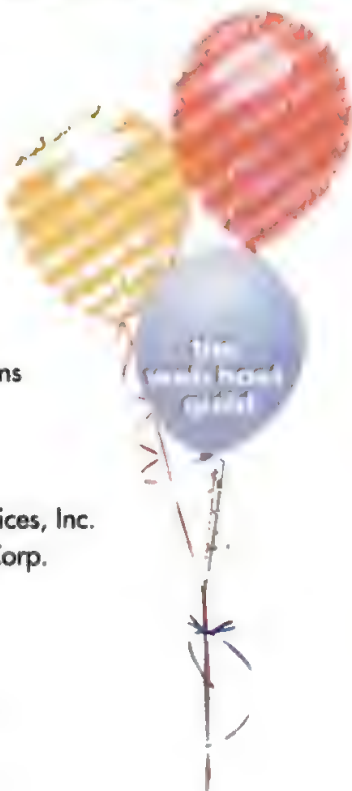
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Web Host Guild MEMBERSHIP

Charter Members

of the Web Host Guild — the first members to join — embody the Guild's high standards and have been fundamental in establishing the certification criteria that protect consumers.

Concentric Network
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 NetMechanic
 Interliant, Inc.
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 9 Net Avenue
 Advanced Web Creations
 Affinity Hosting LLC
 Alabanza Inc.
 CI Host
 Datarealm Internet Services, Inc.
 DeZines Web Hosting Corp.
 E-Access
 Interspeed
 Media3
 OnLine Marketing
 Superb Internet Corp.
 TerraNet
 Tri Star Web
 ValueWeb
 Virtualis
 Virtualscape
 WebHosting.com

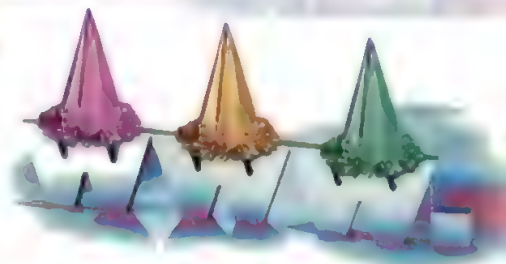


WHG members who followed the founding Charter members into the Guild are reputable Web hosting firms that have agreed to uphold high WHG standards and have met all Guild certification criteria.

Digital Nation
 1 2 3 HostMe!
 Interactive Internet
 Interland
 Netcom
 WebCom
 SiteHosting.net
 High Speed Hosting
 American Data Technology, Inc.
 CommuniTech.Net
 Creative Data Concepts Limited, Inc.
 LexiConn Internet Services, Inc.
 VServers

Express Technologies

INetU
 Jumpline
 SkyNetWEB
 Digital Telemedia
 Netcetera
 Rackspace
 Teleport
 HostCo
 Verio



Affiliate members add value to hosting members with beneficial related products and services. Each has demonstrated strong customer support and maintains a topnotch reputation in the Internet community.

Web Site Garage
 ibill (Internet Billing Company, Ltd)
 WebTrends Corporation
 Miva Corporation
 eShare
 Daniels & Associates
 Ensim

Why the Guild Seal Matters

We've all heard about the poor guy who gets his company's Web site all set to debut and then picks the wrong company to play Web host.

- The Web host company offers all kinds of freebies, its site looks pretty spiffy, and the salesman is cool. He makes them sound like they know what they're doing, which is a good thing, since our guy's technical reach is limited. 'That's why I'm bringing in a Web hosting outfit,' he says, excited that his Web site could make a real difference for his business.
- Alas, our guy's life quickly deteriorates before a succession of Web site problems. Customers can't access it and our guy's hosting company is a little spotty on phone support during business hours. Rousting anybody after hours for technical support is impossible.
- Then, when he manages to check the site himself, he sees pages lost, others corrupted. 'Where are they?' he thunders, but tough luck: the hosting company doesn't do daily or weekly backups.
- After three weeks and eager to check out who's been to his Web site, our guy finds out he can't get access to his site logs. That's when he loses it and demands his money back. Sorry, Jack, no money back, he's told, and they've already billed his credit card for month two.
- Our guy's story does have a happy ending, though. Halfway through the second month, our guy's hosting company folded and stole away in the night like a pack of camel thieves, after less than six months in business. Fortunately, our guy had read about the Web Host Guild, checked out their site at whg.org, and has picked a member as his new Web hosting company, safe in the knowledge that he'll finally get the support, backup, and reliability he needs.

Product Company	Page No.	Product Company	Page No.
Acer Aspire 6171 Acer America Corp.	151	Jack Nicklaus 6: Golden Bear Challenge Activision Inc.	230
Acer FotoPrisa 300P Acer Peripherals America	45	JumpStart and Blaster Learning Games Knowledge Adventure Inc.	234
Age of Empires II: The Age of Kings Microsoft Corp.	228	Kodak Personal Picture Maker PM100 by Lexmark Lexmark International Inc.	45
AlohaBob's PC-Relocator Eisenworld	64	LEGO MindStorms Droid Developer Kit LEGO	234
AltGen Altiserv AltGen Communications Inc.	125	LEGO MindStorms Robotics Discovery Set LEGO	234
AMD Athlon Advanced Micro Devices Inc.	118	Little Tikes Cozy Coupe Mouse KB Gear Interactive	234
Amorphium Play Inc.	102	Logitech WingMan Force Feedback Mouse Logitech	234
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APC DP Series American Power Conversion Corp.	110	Matchbox Construction Zone CAT Controller Mattel Media	234
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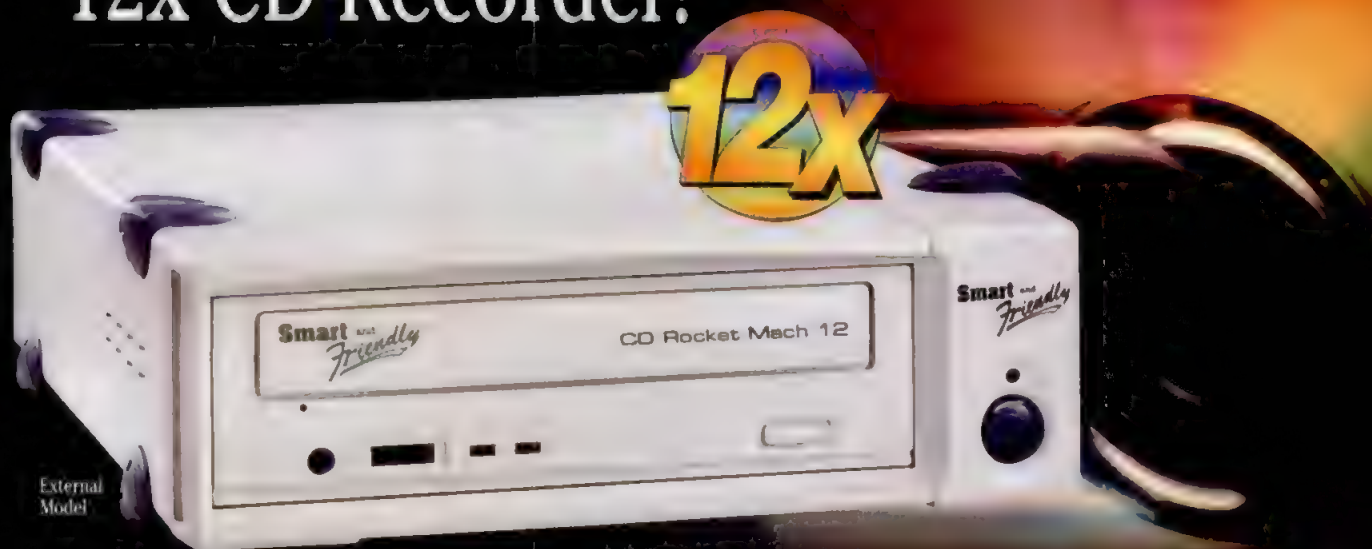
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CTXTM44C	AMD K6-300MHz	15"	32MB PC 100	6.4GB UDMA	40X	PCI/2MB	Mid-Tower	\$17/Month	\$559.99	\$159.99
CTXTM55A	AMD K6-2/400 3DNow!	15"	64MB PC 100	6.4GB UDMA	42X	AGP/8MB	Micro-ATX	\$19/Month	\$629.99	\$229.99
CTXTM56B	AMD K6-2/475 3DNow!	15"	64MB PC 100	8GB UDMA	40X	AGP/8MB	Micro-ATX	\$21/Month	\$699.99	\$299.99
CTXTM50B	Celeron 400MHz	15"	64MB PC 100	8GB UDMA	40X	AGP/8MB	Mid-Tower	\$22/Month	\$719.99	\$319.99
CTXTM57B	AMD K6-2/400 3DNow!	15"	128MB PC 100	12GB UDMA	40X	AGP/8MB	Micro-ATX	\$24/Month	\$769.99	\$369.99
CTXTM51B	Celeron 500MHz	15"	96MB PC 100	12GB UDMA	40X	AGP/8MB	Mid-Tower	\$27/Month	\$899.99	\$499.99
CTXTM39B	AMD K6-III/400 3DNow!	17"	96MB PC 100	8GB UDMA	40X	AGP/8MB	Mid-Tower	\$30/Month	\$959.99	\$559.99
CTXTM42D	Pentium III 450MHz	17"	128MB PC 100	12GB UDMA	40X	AGP/8MB	Mid-Tower	\$33/Month	\$1069.99	\$669.99
CTXTM47B	AMD K6-III/450 3DNow!	17"	128MB PC 100	19GB UDMA	40X	AGP/8MB	Mid-Tower	\$35/Month	\$1079.99	\$679.99
CTXTM43D	Pentium III 500MHz	17"	128MB PC 100	12GB UDMA	40X	AGP/8MB	Mid-Tower	\$36/Month	\$1139.99	\$739.99
CTXTM45C	Pentium III 550MHz	17"	96MB PC 100	20GB UDMA	40X	AGP/8MB	Mid-Tower	\$42/Month	\$1349.99	\$949.99
CTXTM46B	Pentium III 600MHz	17"	128MB PC 100	13GB 7200 RPM UATA/66	40X	ATI Xpert 128/16MB	Mid-Tower	\$47/Month	\$1529.99	\$1129.99
CTXTM52A	Pentium III 667MHz	17"	128MB PC 100	18GB 7200 RPM UATA/66	40X	Voodoo 3 2000/16MB	Mid-Tower	\$53/Month	\$1749.99	\$1349.99
CTXTM53A	Pentium III 733MHz	17"	128MB PC 100	27GB 7200 RPM UATA/66	DVD	Voodoo 3 2000/16MB	Mid-Tower	\$63/Month	\$1999.99	\$1599.99

*Call For details on Tiger's Internet Rebate. ¹ Monthly payments when purchased using the Tiger Credit card. Ask about special financing programs available. ² CD-ROM speeds are variable, maximum speeds are shown. Sorry, we do not offer price protection in the event prices rise or fall. Call for warranty information. All systems include a 1-year upgradable Depot warranty. See www.tigerdirect.com/warranty for entire policy. Copyright, 1999, TigerDirect. All trademarks acknowledged. Monitor viewable areas: 15"—13.9", 17"—15.8". The AMD logo, K6, 3DNow!, and combinations thereof, are registered trademarks of Advanced Micro Devices, Inc.

TigerBook Z-Series

TigerBook Z3 — 300MHz

- AMD K6-2/300 • 12.1" STN Passive Color LCD SVGA
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- 24x CD-ROM Drive† • 1.44MB Floppy Drive
- 56K v.90 PCMCIA Modem • Windows 98

TigerBook Z5 — 380MHz

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abort. retry. fail?

THE LIGHTER SIDE OF
PERSONAL COMPUTING

Edited by Don Willmott

Holiday Shopping Suggestions From eBay

Nothing says "merry Christmas" like an alien-head key chain with a hidden knife!

A three-headed cobra incense burner? Just what I wanted!

And for little Sally, a box of explosives (don't worry, it's empty).

How about a creepy death mask to hang in the baby's room?

Everybody loves trolls.

You can never have too many shoes, or can you?

Here's a collectible "WeirdOH" from the sixties. Great for the mantel.

Here's spooky tiki to give your holidays a Polynesian vibe.

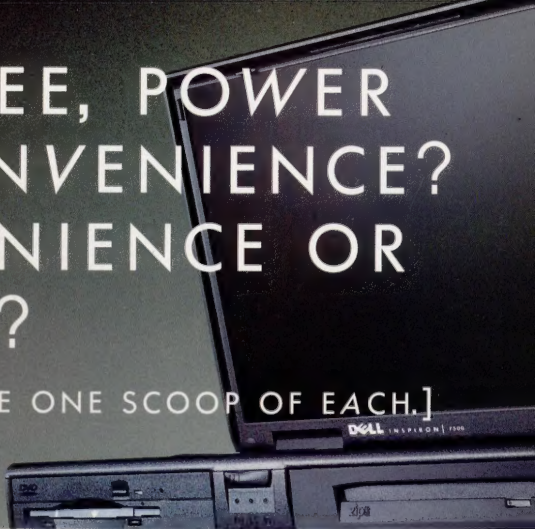
Nice—an hourglass decorated with skulls to remind you that you're going to die. Happy holidays!

This ashtray proves it once and for all: Clowns are scary.

If your entry is used, we'll send you \$50 and a PC Magazine T-shirt. Send your entries to Abort, Retry, Fail?, PC Magazine, 28 E. 28th St., New York, NY 10016-7930 or via e-mail to don_willmott@zd.com.

LET'S SEE, POWER OR CONVENIENCE? CONVENIENCE OR POWER?

[OH HECK, TAKE ONE SCOOP OF EACH.]



LIFE IS FULL OF TIMES WHEN YOU CAN'T HAVE YOUR CAKE AND EAT IT TOO. THIS ISN'T ONE OF THEM. IN FACT, THERE'S QUITE A BIT OF CAKE HERE. BASICALLY WHAT YOU CAN GET IN THE NEW DELL® INSPIRON™ 7500 IS UP TO A 15.4 INCH SXGA SCREEN – PLUS A PENTIUM® III PROCESSOR – WHICH MEANS YOU'LL HAVE ALL THE MULTIMEDIA, MEMORY, SPEED AND RAW POWER OF MANY FULL-SIZED DESKTOPS IN THIS HANDY TRAVELING SIZE. AND WITH THE 4-SPINDLE CAPABILITY YOU CAN HAVE UP TO 75GB* OF STORAGE, OR YOU CAN RUN YOUR ZIP, FLOPPY AND CD DRIVES RIGHT OFF YOUR BATTERY. ALL AT THE SAME TIME. YES, COMPROMISE IS FOR THOSE WHO CAN'T DECIDE WHAT THEY WANT.

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- 32MB SDRAM (up to 512MB)
- 4.8GB* Ultra ATA HD (up to 25GB*)
- Removable Combo 24X Max* Variable CD-ROM and Floppy Drive
- 2X AGP 4MB ATI RAGE Mobility™ P 3D Video (up to 8MB)
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